

Stillwater Area Public Schools

Laptop Initiative Evaluation Report

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◆ Executive Summary

This report describes the results of an evaluation of the Stillwater Area Public Schools laptop initiative at Stillwater Junior High School (SJHS) and Oak-Land Junior High School (OLJHS). A major impetus for the laptop initiative was the need to increase junior high students' engagement in school. The district hoped to enhance students' interest in learning by increasing the use of technology in the curriculum. The district also identified a need to develop students' "21st century skills," such as critical thinking, problem solving, technology literacy, and to support teachers in meeting the needs of diverse learners.

The laptop initiative began in November 2003 when each teacher at SJHS and OLJHS received an Apple laptop computer. Over the next few months the teachers participated in professional development at both the school and district level. The professional development focused on increasing teachers' knowledge and skills related to using the laptops and integrating technology into their curriculum. Teacher professional development continued during summer 2004 and was ongoing at both the district and school level during the 2007-2008 school year.

In spring 2004, students at both schools were introduced to Apple laptops. At OLJHS, each student received a laptop for use during the school year, whether they were at school or at home, and it is often referred to as a one-to-one program. SJHS provided carts of Apple laptops for teachers to check out for student use during class time. The student-to-computer ratio with the laptop carts at SJHS was approximately 3:1. Both schools also made wireless Internet access available throughout their buildings and offered students and parents online access to course assignments and grades.

In summer 2007, the district contracted with the Center for Applied Research and Educational Improvement (CAREI) in the University of Minnesota's College of Education and Human Development to evaluate the laptop initiative. The overall goal of the evaluation was to collect information about the impact on teaching and learning as a result of implementing the laptop initiative at OLJHS and SJHS.

Evaluation Design and Methods

The evaluation was designed to address three areas that the district hoped would have been affected by the laptop initiative: teaching, student outcomes, and parents. The specific topics within each area are shown below.

Teaching

- Instructional behaviors (preparation and teaching)
- Content of the curriculum
- Facilitation of students' higher order thinking
- Training and continuing professional development

Student Outcomes

- Student-teacher and student-student communication
- Opinions about the use of laptops
- On-task classroom behavior and student engagement
- Student achievement

Parents

- How parents assist their children with technology-based schoolwork
- Frequency and desirability of accessing students' homework assignments and grades
- Changes in parent-child conversations as a result of greater access to technology

CAREI employed multiple methods to collect information on how these areas may have been affected by implementation of the laptop initiative. The methods were as follows:

- 1) Online surveys for students, teachers, and parents
- 2) Individual interviews with teachers
- 3) Classroom observations
- 4) Standardized achievement tests
- 5) Focus groups with sophomores at Stillwater Area High School who had been students at either SJHS or OLJHS during three years of the laptop initiative

The surveys and achievement tests included all students, teachers, and parents at SJHS and OLJHS. The individual teacher interviews and the classroom observations were intentionally focused on teachers who had been identified by their principal and technology coordinator as strong technology integrators. Thus, these data were not intended to represent all teachers or classrooms at SJHS and OLJHS. A random sample of sophomore students who had attended each junior high school was invited to participate in the focus groups at the high school.

CAREI researchers worked with district staff to develop data collection instruments that were specific to the Stillwater Area Public Schools' laptop initiative. They also drew on existing instruments, where possible. Because we were studying how laptops affected teaching and learning, the survey questions and observation protocols specifically addressed teaching and learning issues while the laptops were in use.

Results

The study results detailed numerous ways in which the laptop initiative may have had a positive influence on teaching and learning. Many other factors in addition to, or in place of, the use of computers and laptops may have affected the outcomes described in this report, however. The results of the study should not be used as evidence of a causal relationship between the use of computers and laptops and changes in teaching and learning. To estimate the potential influence of other factors would have required the inclusion of a comparison school in the study design that was similar to both SJHS and OLJHS, but did not have laptops or computers available to

students. This type of design was not feasible within the scope of this study. Nonetheless, the study provides a detailed portrait of teaching and learning in a laptop environment.

When interpreting the study results it is important to keep in mind that data from the surveys and interviews were based on the self-report of students, teachers, and parents. As with any self-report measure in any study, people may have, intentionally or not, provided the response options that they thought would make them or their school look best. To reduce this possibility, teachers, students, and parents in this study completed the surveys anonymously. The evaluation design also included researcher observations of classroom instruction with computers or laptops to serve, in part, as a check against the possible bias of self-report. Although the scope of the information gathered through the classroom observations was not as broad as the scope of the student and teacher surveys or the teacher interviews, a qualitative comparison of the results among these data sources did not reveal any substantive differences that would suggest bias.

Teaching

The results indicated that the laptop initiative contributed to enhancements in the quality of teaching at both SJHS and OLJHS. Through surveys and interviews, teachers provided many examples of how their instruction and preparation for instruction had changed in ways that benefited students. Data from researchers' observations of classroom instruction showed that the quality of instruction was high at both SJHS and OLJHS.

Facilitation of Students' Higher Order Thinking

Information from multiple sources indicated that the laptop initiative expanded teachers' capacity to facilitate students' higher order thinking. On the teacher survey, eighty-four percent of the teachers said access to a computer or laptop contributed some or a lot to students demonstrating more higher-order thinking. In interviews with the researchers, teachers readily described how their instruction had changed to incorporate more learning activities that helped develop students' critical thinking skills. When the researchers observed instruction that incorporated the laptops they found that the level of higher order thinking was high in both schools. They also found strong use of disciplinary knowledge in the instruction. Students and teachers were addressing the central ideas of a discipline or topic thoroughly and exploring connections and relationships to produce deep understanding.

Instruction

The laptop initiative also supported changes in other areas of teacher practice. Ninety-four percent of teachers said they were better able to access diverse teaching materials and resources when students had access to computers or laptops. Further, 90% of the OLJHS teachers and 81% of the SJHS teachers agreed with the statement, "When I know that my students will have access to computers or laptops I am better able to individualize my curriculum to fit student needs." Ninety-one percent of teachers agreed that a laptop helps them to access more up-to-date

information for their students, 90% of teachers agreed that through the use of computers or laptops students are able to explore topics in greater depth, and 90% of teachers agreed that having computers or laptops in the classroom helped them create materials that better meet district goals.

The survey results were consistent with data from the teacher interviews. During interviews with the researchers, most of the teachers offered examples of how their instruction had changed in the following areas:

- instruction became more student-centered;
- students had more opportunity to actively explore information; and
- instructional content was more up-to-date and interesting for students.

For most of the teachers, the laptop initiative seemed to facilitate changes in practice that were consistent with their existing beliefs about effective instruction. The teachers described how students' access to laptops had made it easier to implement instructional strategies they had long valued, such as reducing the amount of time they spent lecturing and instead, asking students to find information and synthesize it to form conclusions. The teachers, however, were less likely to remark on change in how often students collaborated with their peers in their learning. Some teachers acknowledged challenges that can occur when students have access to computers or laptops. When asked if using computers or laptops in the classroom increased their workload, the teachers' responses were split nearly half and half between agree (51%) and disagree (49%).

From a more holistic perspective, some interesting ideas emerged about how the introduction of laptops might change instructional practice and teacher beliefs about effective instruction. One surprise to CAREI researchers was that, as one teacher said, even teachers who have a student-centered teaching philosophy can be helped by laptops. There are things laptops facilitate—things even the best teacher may have long wanted to do but were not possible before laptops.

Content of the Curriculum

Results from the teacher survey suggested a positive relationship between the laptop initiative and the content of the curriculum. Eighty-four percent of the teachers agreed that they were better able to meet their curriculum goals when students were using computers or laptops. This result implies that this students' access to computers or laptops does not detract from curriculum goals, as some people may fear. In observations of instruction with laptops at both schools, researchers found that a high proportion of the students were focused on the intended curriculum objectives when using the laptops. In addition, the technology use in the lesson represented learning activities that could not otherwise be easily done. These results provide evidence that the laptops are being used to enhance the curriculum rather than serving as an add-on to the standard curriculum.

Students

The study results also offered evidence of how the use of computers and laptops can benefit student engagement and learning. Students and teachers at both schools reported advantages for students that were associated with the laptop initiative.

On-Task Classroom Behavior and Student Engagement

Information from several sources suggested that student engagement was higher when students had access to computers or laptops. On the teacher survey, 90% of the teachers said students show greater engagement in the task when they are using computers or laptops. When researchers observed instruction, they found that students' physical engagement in the lesson was high at both 15 and 30 minutes into the class period. The survey results also showed that teachers believe students explore topics in greater depth when they have access to computers or laptops.

Another indicator of students' engagement in learning is how often students use a laptop to learn things beyond what teachers have assigned in class. Fifty-five percent of the SJHS students and 60% of the OLJHS students said they use the laptop to learn about things not assigned in class. When asked to comment on this use, the majority of the students at both schools described how they used their laptops to pursue their curiosities once their interests were piqued about a topic. This suggests that students' access to technology could spark or, at minimum, support the development of life-long learning practices and perspectives.

Many students associated positive effects with their use of computers or laptops. For example, 93% of the SJHS students and 92% of the OLJHS students agreed when asked if they were more likely to revise/edit their work when it was done on a computer or laptop. Ninety percent of the students at both schools agreed that having access to a computer or laptop helped them be better organized.

Opinions about the Use of Laptops

Students' opinions about the laptops, as measured by their responses on the student survey, were very positive. Only a small percentage of students at each school indicated that they wanted to use laptops in school less than they do now. Similarly, only a small proportion said that they wanted to use a computer or laptop for homework less than they do now. SJHS students were notably more likely than OLJHS students to indicate that they'd like to use laptops in school more (76%, 31%) and use a computer or laptop for homework more (78%, 34%). SJHS students were also more likely to say that it makes a lot of difference whether they have access at home to the same software their teachers use in class (68%, 37%).

Communication Between Teacher-Student and Student-Student

Student access to a computer or laptop was more likely to increase their frequency of communication with teachers when students were at home than when students were at school.

On the student survey, about one-third indicated that they communicated more with their teachers when they had access to a computer or laptop at home. The effect on students' communication with their peers was similar. About half of the students indicated they communicated more with other students about school projects and assignments when they were at home. When asked about communication with their peers while at school, over one-third reported a higher frequency of communication when they had access to a computer or laptop.

Achievement

With one exception, statistical analyses of the growth in student achievement in reading and mathematics during junior high, as measured by standardized tests, revealed no statistically significant differences between students at SJHS and students at OLJHS. SJHS students who began 7th grade in fall 2006 had a higher rate of growth in reading achievement from fall 2006 to fall 2007 than their peers at OLJHS. The estimated average score on the reading test for SJHS students was 219.8 in fall 2006 and 224.4 in fall 2007. In contrast, the estimated average score on the reading test for OLJHS students was 222.1 in fall 2006 and 225.1 in fall 2007. The results suggest that neither the one-to-one model nor the cart model of laptop access detract from students' performance on standardized assessment measures.

Parents

Results from the parent survey illustrated how parents and their children have benefited from the initiative. One component of the laptop initiative was providing parents and students with the means to access students' homework assignments/class calendar and grades online and at least three-quarters of the parents surveyed indicated that they used this service. Eighty-five percent of the SJHS parents and 58% of the OLJHS parents said it was very important for them to have online access to their child's assignments/class calendar and grades.

Over three-fourths of the parents at each school reported that they had worked on schoolwork with their child using a computer. Most often the parents reported working with their child to edit a paper or research information. This suggests that parents are not discouraged from helping their child with schoolwork, even though it may require knowledge of computers and software. It appears that although there could be some new skills or insights that parents may need to help their student(s) with homework, parents are not opposed to this challenge.

Sixty-one percent of the SJHS parents and 46% of the OLJHS parents said they spend more time talking with their child about school work now in comparison to previous years when parents could not check students' assignments and class calendar online. When asked how the availability of online grades affected their communication with their child, 66% of the SJHS parents and 53% of the OLJHS parents indicated that they now spend more time than before talking with their child about grades.

Comparisons Between the 1:1 and 3:1 Student-to-Laptop Ratios

Given the different student-to-laptop ratios at SJHS and OLJHS, a secondary focus of the study was to explore potential differences in how the laptop initiative, among other factors, may have affected teaching, learning, and parents at each school. Statistically significant differences occurred in several areas. Teachers at SJHS were more likely to report that access to a computer or laptop in the classroom contributes a lot to students' interest in class. SJHS students were more likely to say that using a computer or laptop, at school or at home, makes schoolwork more enjoyable. As noted earlier, SJHS students were also more likely than OLJHS students to indicate that they'd like to use laptops in school more and use a computer or laptop for homework more. Forty-four percent of SJHS students said they do not have enough access time on a computer or laptop at home to work on their homework. A higher proportion of OLJHS teachers agreed with the statement "there is more open communication between students and teachers in classrooms when computers or laptops are in use." OLJHS teachers were also more likely to agree that students' access to computers or laptops made it easier for them to individualize the curriculum to fit student needs and more able to cover more material in class. Notable differences occurred as well on the parent survey results. SJHS parents checked their child's assignments and grades online significantly more often than OLJHS parents and a higher proportion of SJHS parents said it was very important for them to have online access to assignments and grades.

In sum, the study data offer numerous examples of positive changes that teachers and students have observed in teaching and learning when computers or laptops are made available to students. Parents and students have also benefited from online access to information about their students' assignments and grades. The implications of the study data are less obvious, however, when comparisons are made between the 3:1 student-to-laptop ratio at SJHS and the 1:1 ratio at OLJHS. Further study may be needed to clarify potential similarities and differences between the models regarding their influence on teaching and learning.

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◆ Overview

The Stillwater Area Public Schools' laptop initiative began in November 2003 when each teacher at Stillwater Junior High School and Oak-Land Junior High School received an Apple laptop computer. Over the next few months the teachers participated in professional development at the school and district level to increase their knowledge and skills related to using the laptops and integrating technology into the curriculum. In February 2004 each student at Oak-Land Junior High School (OLJHS) received an Apple laptop computer for use during the school year whether they were at school or at home. This model is known as the one-to-one model. In March 2004 Stillwater Junior High School (SJHS) increased the number of laptops available to students for classroom use. As a result the student-computer ratio in the building was reduced to approximately 3:1. This model is known as the cart model because classroom sets of laptop computers are located on carts and moved from classroom to classroom as needed. Teacher professional development continued during summer 2004 and was ongoing at both the district and school level during the 2007/2008 school year.

A major impetus for the laptop initiative was the need to increase junior high students' engagement in school. The district hoped to enhance students' interest in learning by increasing the use of technology in the curriculum. The district also identified a need to develop students' "21st century skills," such as critical thinking, problem solving, technology literacy, and to support teachers in meeting the needs of diverse learners.

In summer 2007, the district contracted with the Center for Applied Research and Educational Improvement (CAREI) in the University of Minnesota's College of Education and Human Development to evaluate the laptop initiative. The overall goal of the evaluation was to collect information about the impact on teaching and learning as a result of implementing the one-to-one model at OLJHS and the cart model at SJHS. This report describes the design and the results of this study.

◆ Evaluation Design and Methods

Evaluation Goals

The evaluation was designed to address three areas that the district hoped would have been affected by the laptop initiative: teaching, student outcomes, and parents. The specific topics within each area are shown below.

Teaching

- Instructional behaviors (preparation and teaching)
- Content of the curriculum
- Facilitation of students' higher order thinking
- Training and continuing professional development

Student Outcomes

- Student-teacher and student-student communication
- Opinions about the use of laptops
- On-task classroom behavior and student engagement
- Student achievement

Parents

- How parents assist their children with technology-based schoolwork
- Frequency and desirability of accessing students' homework assignments and grades
- Changes in parent-child conversations as a result of greater access to technology

Evaluation Methods

Participants

The study participants were as follows: students and teachers at SJHS and OLJHS, parents of students at SJHS and OLJHS, and 10th grade students at Stillwater Area High School.

In October 2007 there were 1,016 students enrolled at Oak-Land Junior High School and 1,084 enrolled at Stillwater Junior High School. Table 1 compares the characteristics of the students at each school. Overall, the student demographics were very similar. SJHS had a slightly higher proportion of students enrolled in 9th grade than OLJHS (38% versus 34%). OLJHS had a slightly higher proportion of students who were of minority race/ethnicity than SJHS (10% versus 4%).

Table 1. Comparison of student demographics¹ between SJHS and OLJHS.

	SJHS N=1084	OLJHS N=1016
7 th grade	30%	32%
8 th grade	32%	34%
9 th grade	38%	34%
Female	49%	52%
Minority race/ethnicity	4%	10%
Free- or reduced-price lunch	11%	12%
Special education	10%	12%
English language learner	<1%	<1%

Measures and Procedures

With the exception of the standardized achievement tests, all measures were developed by CAREI in consultation with district staff. Table 2 shows which topics were addressed by each measure.

¹http://education.state.mn.us/MDE/Data/Data_Downloads/Student/Enrollment/School/index.html
retrieved June 19, 2008.

Table 2. Relationship between evaluation topics and measures for data collection.

	Classroom Observations	Teacher Interviews	Focus Groups	Standardized Achievement Tests	Online Surveys
Instructional behaviors (preparation and teaching)	✓	✓			✓
Content of the curriculum		✓			✓
Facilitation of students' higher order thinking	✓	✓			✓
Training and continuing professional development					✓
Student-teacher and student-student communication			✓		✓
Opinions about the use of laptops			✓		✓
On-task behavior and student engagement	✓		✓		✓
Student achievement				✓	✓
How parents assist their children with technology-based schoolwork					✓
Frequency and desirability of accessing students' homework assignments and grades					✓
Changes in parent-child communication					✓

Online Surveys

CAREI developed the content of the teacher survey, student survey, and parent survey in collaboration with district and school staff. Many of the items for the teacher survey and the student survey were drawn directly from or adapted from surveys developed by the Maine Learning Technology Initiative². The items on all three surveys were intentionally written to reflect the context of both the cart model at SJHS and the one-to-one model at OLJHS. For example, teachers and students were asked to answer some questions based specifically on their behavior when students had access to computers or laptops in the classroom. This specification was necessary because the purpose of the study was to compare teaching and learning in the presence of computers or laptops and these tools were not available every day in classrooms at SJHS. The survey items were also written to reflect the reality that students at SJHS may use computers at school in the computer lab, so the surveys used the phrase “computer or laptop” in many areas. Finally, the items were worded to include both desktop computers and laptops to reflect the fact that students may use either a laptop or a desktop computer at home. The content of each survey was identical for respondents at SJHS and respondents at OLJHS.

District staff created an online version of each survey. Technology coordinators at each school added links for the surveys to the online school planners so students, parents, and teachers could access the surveys easily. The district provided CAREI with a spreadsheet of response data for each online survey. Tables were prepared for each survey that showed how the respondents from each school answered each item. A Pearson Chi-Square statistic was calculated for each survey item to determine the probability that any observed differences in how respondents from each school answered the item were due to chance factors rather than differences in respondents’ behavior or perception. In a few cases an independent samples t-test was used in place of a Pearson Chi-Square test when the response scale for the survey item was consistent with the characteristics recommended for use of the t-test statistic.

Rate of Completion for Student Survey. A total of 856 students completed the student survey; 17 students were excluded from the analysis because they did not indicate which school they attended. Of the remaining 839 students, 218 were enrolled at SJHS and 621 were enrolled at OLJHS. The response rate for SJHS students was 20.1% in contrast to the response rate of 60.1% for OLJHS students.

Table 3 shows the grade level and gender of the students from each school who responded to the survey. Ideally these proportions would be similar to the proportions in the student population as a whole so that the characteristics of the survey respondents mirror the characteristics of students enrolled in each school. At each school, 7th grade students were more likely to complete the survey than their older peers. At SJHS, 7th grade students made up 53% of the survey respondents but only 30% of the student population. Likewise, at OLJHS, 7th grade students

² Silvernail, D.L. and Lane, D.M.M. (February 2004). The Impact of Maine’s One-to-One Laptop Program on Middle School Teachers and Students. Maine Education Policy Research Institute, University of Southern Maine Office. http://usm.maine.edu/cepare/Reports/MLTI_Report1.pdf, retrieved January 15, 2008.

comprised 43% of the survey respondents but only 32% of the student population. A higher proportion of 8th grade students completed the survey at OLJHS than at SJHS; for OLJHS, the proportion of 8th grade students who completed the survey was similar to the proportion of 8th grade students in the student population. For both schools, the proportion of male and female students who completed the survey was similar to the proportion of male and female students enrolled in the school.

Table 3. Comparison of student demographics between survey respondents and school's student population.

	Students Who Completed the Survey	Students Enrolled
SJHS Junior High School	N=218	N=1084
7 th grade	53%	30%
8 th grade	22%	32%
9 th grade	25%	38%
Female	56%	54%
Oak-Land Junior High School	N=621	N=1016
7 th grade	43%	32%
8 th grade	35%	34%
9 th grade	22%	34%
Female	50%	56%

Table 4 compares SJHS and OLJHS with respect to the course grades the survey respondents said they typically received. The two schools' proportions were very similar with the majority of students saying that they received mostly As or mostly As and Bs.

Table 4. Typical course grades for survey respondents, by school.

	Mostly A's	Mostly A's and B's	Mostly B's	Mostly B's and C's	Mostly C's	Mostly C's and D's	Mostly D's
<i>What grades do you normally receive in school:</i>							
SJHS	34%	39%	9%	12%	1%	4%	2%
OLJHS	31%	38%	6%	17%	4%	3%	2%

Rate of Completion for Teacher Survey. A total of 68 teachers completed the teacher survey for a response rate of 59%. Twenty-eight of the survey respondents worked at SJHS and 40 worked at OLJHS. These numbers represent 47% and 71% of the teaching staff at SJHS and OLJHS, respectively. The OLJHS survey results were more likely to represent all OLJHS teachers because over two-thirds of the teachers completed a survey. Despite the lower rate of completion by SJHS teachers, survey data indicate that the SJHS respondent group was not confined to teachers who were high frequency users of the laptop carts. SJHS teachers were asked to respond to a survey question about how often their students used laptops in their classroom this year. As shown in Table 5, the number of days varied widely among the teachers who completed the survey. Almost one-fourth (23%) of the teachers said students had used the laptops for more than

60 days. In contrast, 19% said their students had used laptops less than 10 days. The wide range in how often students had access to laptops in the classroom implies that the survey results for SJHS teachers represent teachers who vary widely in their use of the laptop carts.

Table 5. Number of days SJHS students have used laptops in classroom this year.

	Less than 10 days	21-30 days	31-40 days	41-50 days	51-60 days	More than 60 days
Survey question: <i>“For approximately how many days have students used laptops in your classroom this year?”</i> (N=26)	19%	19%	15%	19%	4%	23%

Table 6 compares the characteristics of teachers from each school who completed the survey. Although the difference was not statistically significant, the SJHS respondents had been teaching an average of 15 years compared to 13.3 years for the OLJHS respondents. A slightly higher proportion of the SJHS teachers worked full-time: 89% at SJHS versus 85% for OLJHS. A slightly higher proportion of the SJHS respondents were art teachers, English language arts teachers, and mathematics teachers; a slightly higher proportion of the OLJHS respondents were health or physical education teachers, science teachers, and special education teachers.

Table 6. Teacher demographics for survey respondents, by school.

<u>Survey question</u>	SJHS N=28	OLJHS N=38[#]
Including this year, how many years have you worked as a teacher?		
Mean	15.0	13.7
Median	14.5	12.0
Standard Deviation	8.4444	9.151
Range	1-32	2-35
Your teaching assignment:		
Full-time	89%	85%
Part-time	11%	15%
What subjects do you primarily teach?^Δ (N=24 SJHS) (N=37 OLJHS)		
Art	7%	0%
Business	4%	0%
Computers/Technology	0%	3%
English Language Arts	21%	16%
Family and Consumer Science	0%	3%
Health or Physical Education	4%	14%
Industrial Arts	4%	0%
Mathematics	21%	14%
Music	7%	3%
Science	11%	19%
Social Studies	11%	11%
Special Education	11%	16%
Vocational Education	0%	0%
World Languages	4%	8%
Other	14%	3%
	alternative education – all subjects, science, robotics, school psychologist	video production and theatre

[#]Information in this table was not available for 2 of the respondents from OLJHS.

^ΔMultiple response items.

Rate of Completion for Parent Survey. Overall, 505 parents completed the survey. Eleven of them did not indicate which school their child attended so their surveys are not included in this report. A higher proportion of parents of OLJHS students completed the survey 31% (313) than parents of SJHS students, 17% (181).

Teacher Interviews

A semi-structured interview protocol was developed by researchers in consultation with district staff. The purpose of the teacher interviews was to gather information on how the laptop initiative might have affected the following: how teachers prepare for and deliver instruction, the content of the curriculum, and teachers' capacity to facilitate students' higher-order thinking.

The interview protocol asked teachers to reflect on how much they thought having laptops influenced their instruction in four specific areas: student-centered instruction, active exploration of information, critical thinking, and student collaboration. Each of the first three areas is part of the *National Educational Technology Standards for Teachers 2000* (International Society for Technology Education, 2000); the fourth area of student collaboration appears in the 2008 version of the standards. In contrast to the classroom observation protocol, which was designed to measure qualities of the instruction on a particular day, the interview was intended to collect information on how teachers' practice may have changed since the start of the laptop initiative.

Researchers asked the technology coordinator and principal at each school to compile a list of 6-8 teachers whom they considered to be strong in terms of their integration of laptops into instruction. Then, the researchers contacted each teacher and invited them to participate in a telephone interview. During the interview, the researchers made written notes of teachers' responses to each question. Researchers reviewed the notes from each teacher interview to identify themes in the teachers' responses for each item. Results for SJHS teachers and OLJHS teachers were compared to determine if any differences existed between the teachers' experiences at each school.

In May 2008, each school identified 8 teachers for inclusion in the interviews. Twelve of the 16 agreed to participate in an interview; 7 were teachers at SJHS and 5 were teachers at OLJHS³. Table 7 shows the subject area and grade level(s) taught by the teachers who participated in an interview. One notable difference was that the group of SJHS teachers included a family and consumer sciences teacher and a world languages teacher, whereas the group of OLJHS teachers was comprised of teachers in the core subjects.

Table 7. Subject area and grade level of teachers included in interviews, by school.

	Number of SJHS Teachers (N=7)	Number of OLJHS Teachers (N=5)
Subject Area		
English Language Arts	1	2
Family and Consumer Science	1	0
Mathematics	1	1
Science	1	1
Social Studies	2	1
World Languages	1	0
Grade Level		
7 th	2	1
8 th	0	2
9 th	3	2
Multiple	2	0

³ One additional OLJHS teacher had to cancel the interview due to a family emergency and was not able to reschedule.

Classroom Observation Protocol

Observations of classroom instruction were guided by a protocol comprised of 3 existing tools. The first component was a rubric developed by Newmann, Secada, & Wehlage, (1995) to rate the level of authentic instruction observed. The rubric included four dimensions, as follows:

Higher Order Thinking – Instruction involves students in manipulating information and ideas by synthesizing, generalizing, explaining, hypothesizing, or arriving at conclusions that produce new meanings and understandings for them.

Deep Knowledge – Instruction addresses central ideas of a discipline or topic with enough thoroughness to explore connections and relationships and to produce relatively complex understandings.

Substantive Conversation - Students engage in extended conversational exchanges with the teacher and/or their peers about subject matter in a way that builds an improved and shared understanding of ideas or topics. 1) The talk is about subject matter in the discipline and includes higher order thinking. 2) The conversation involves sharing of ideas—participants explain themselves or ask questions in complete sentences, and then they respond directly to comments of previous speakers. 3) The dialogue builds coherently on participants' ideas to promote improved collective understanding of a theme or topic.

Connections to the World Beyond the Classroom – Students make connections between substantive knowledge and either public problems or personal experience.

Each dimension was rated on a scale from 1 to 5, with 5 being the highest. Qualitative descriptions for each rating level on each dimension appear in the Appendix.

The second component of the observation protocol included sections from the *Inside the Classroom: Observation and Analytic Profile*, (Horizon Research Inc., 2000). The sections measured the following aspects of the lesson:

- The proportion of students that were physically engaged in the lesson at specific points in the class period;
- The number of minutes during the lesson spent on instructional learning activities;
- The number of minutes during the lesson spent on housekeeping or other non-instructional activities; and
- The proportion of instructional time spent in whole class work, pairs/small group work, and individual work.

Physical engagement was defined as “eyes/hands/feet appropriately tracking instructional activity—including teacher led, whole groups, small group or individual work.”

Finally, the observation protocol included three items from the 11-item *Integration Observation Tool* section of the *Observation Protocol for Technology Integration in the Classroom (OPTIC)*, (Northwest Regional Education Laboratory, 2004). The items measured the following aspects of instruction:

- The degree to which students exhibited collaboration in group activities using technology.
- The extent to which students are focused on the intended curricular objectives when using technology.
- The extent to which the technology use represents learning activities that could not otherwise be easily done.

Each item was rated on a scale from 1 to 5, with 5 being the highest.

Prior to the visits, the principal and technology coordinator at each school compiled a list of teachers in each subject area who they considered to be the most skilled at integrating technology into instruction. Researchers worked with the coordinators to schedule the observation dates at each school to avoid overlap with events such as testing and field trips. In addition, observations at SJHS were scheduled for dates on which the teachers would have a cart of laptops in their classroom. Prior to each scheduled visit, the technology coordinators informed all of the teachers in their building that researchers might visit their classroom to observe instruction on the given day; however, neither the technology coordinator nor the teachers knew which period the researchers would visit any given classroom. Researchers entered the observation data into a spreadsheet and calculated frequencies and percentages for each item on the protocol, by school. Statistical analysis for each item was conducted using the Mann-Whitney test to determine if differences between the schools were statistically significant.

The visits to SJHS took place on November 20, 2007 and December 5, 2007. Researchers visited OLJHS on November 19, 2007 and November 27, 2007. One researcher returned to OLJHS to observe an additional classroom on December 14, 2007 because during the earlier visits the teacher was preparing students for a performance. Researchers completed 11 observations at SJHS and 12 observations at OLJHS. At SJHS the 11 observations included 10 different teachers; one teacher was observed twice. At OLJHS the 12 observations included 7 different teachers; 5 of the teachers were observed twice and 2 additional teachers were each observed once.

Table 8 shows the subject area and grade level(s) of the teachers whose instruction was observed at each school. The teachers at OLJHS taught either 7th grade students or multiple grades of students. In contrast, the majority of teachers observed at SJHS taught 8th grade students, though all grades levels were observed. The number of teachers in English language arts, social studies,

and science was slightly higher at SJHS than at OLJHS. These differences occurred because of the necessity of scheduling the SJHS observations on days that the teachers had the laptop carts checked out.

Table 8. Subject area and grade level of teachers included in classroom observations, by school.

	Number of SJHS Teachers (N=10)	Number of OLJHS Teachers (N=7)
Subject Area		
Art	1	0
English Language Arts	3	1
Mathematics	0	1
Music	0	1
Physical Education/Health	1	1
Science	2	1
Social Studies	2	1
World Languages	1	1
Grade Level		
7 th	2	4
8 th	5	0
9 th	1	0
Multiple	2	3

Standardized Achievement Tests

Students' scores on the Northwest Education Association's Measures of Academic Progress (MAP) tests in reading and mathematics were used to explore how students' levels of access to laptops may be related to their levels of learning. The tests are administered by the schools and the data was obtained from the district. The MAP is a computer-adaptive assessment tool that is designed to align with each state's standards. Since the test is computer-adaptive, there is no "ceiling" score on how high a student can score because the test is designed to continually present more challenging items as the student answers items correctly, therefore providing a more accurate assessment of the student's actual level of achievement. The MAP uses Rasch Unit (RIT) scale scores as its unit of measurement. The name for the unit of measurement is based on the Rasch model for dichotomous data in item response theory which is the theoretical model of measurement on which computer-adaptive testing is based. This score can be interpreted as a number that indicates a student's instructional level, independent of grade level. In addition, an individual student's scores can be compared over time to determine their rate of growth in reading or mathematics achievement.⁴

To describe how SJHS and OLJHS students performed over time depending on the availability of laptops, CAREI examined the MAP reading and math achievement data available for three

⁴ <http://www.nwea.org/assessments/map.asp>, retrieved June 27, 2008.

cohorts of junior high students who would have experienced either the one-to-one model or the cart model of laptop access throughout their junior high years of schooling. CAREI created files of longitudinal data for three cohorts of students at each junior high:

- Cohort I, which began 7th grade in fall 2004
- Cohort II, which began 7th grade in fall 2005
- Cohort III, which began 7th grade in fall 2006

Depending on the district's testing policy, different amounts of data were available in either reading or mathematics for each cohort. Table 9 shows the number of data points for each cohort in reading and mathematics. Students who did not have a test score at each point were excluded from the analysis. Statistical analysis was conducted using a repeated measures split-plot design in order to determine whether differences in student achievement were statistically significant between schools at each time point.

Table 9. Test score availability by student cohort.

	F 2004	S 2005	F 2005	S 2006	F 2006	S 2007	F 2007
Cohort I read (N=618)	X	X	X	X			
Cohort I math (N=591)	X	X	X	X	X		
Cohort II read (N=468)			X	X	X		
Cohort II math (N=455)			X	X	X		
Cohort III read (N=668)					X		X
Cohort III math (N=480)					X	X	X

Focus Group Protocol

In February 2008 CAREI conducted focus groups with six groups of 10th grade students at Stillwater Area High School. Three of the groups included students who had attended SJHS and three groups included students who had attended OLJHS. The purpose of the focus groups was to collect information from students who, as junior high students, had experienced three years of the laptop initiative and now had had one semester of experience at the senior high school, which had a notably lower student computer or laptop ratio than either junior high school. Researchers developed a focus group protocol in collaboration with district staff. The protocol contained a set of 11 open-ended questions about how laptops or desktop computers were used in junior and senior high and how that use may have affected the following: students' interest in a subject, students' learning in a subject, student communication with teachers and peers, and students' preparation for future careers.

Researchers and district staff also developed a brief questionnaire for students to complete at the end of the focus group. The questionnaire contained fixed response questions that were more appropriate to a survey format than a focus group format. The questions concerned students' perceptions about how access to laptops may have affected their grades.

To generate a list of students to invite to the focus groups, district staff first sorted all of the 10th grade students into low, medium, and high achievement level groups based on their scores on the 2007 MCA-II tests in reading and mathematics. Then, within each achievement level group, staff randomly selected 10 students who had previously attended SJHS and 10 students who had previously attended OLJHS. The result was six groups of students, sorted by achievement level and junior high school. District staff told the researchers which sessions corresponded to each achievement level group only after the sessions were completed.

Prior to the focus group date the district mailed a letter to each student's parents to explain the purpose of the focus groups and inform them that their child would be invited to participate. Parents who did not want their child to participate were asked to contact the researchers. Seven parents requested that their child be excluded and district staff randomly selected a replacement for each student. In total, 60 students were invited to participate in the focus groups: 30 former SJHS students and 30 former OLJHS students.

The focus groups took place in a classroom or conference room at the high school during the school day. High school staff gave each student a written reminder about the focus groups the day before their scheduled session. At the start of each session the researchers explained the purpose and procedures for the focus group and how students were selected. Then, they asked students to review a written assent form and sign their name if they were willing to participate. At the end of each focus group the researchers gave students the brief written questionnaire to complete. Students did not need to write their name on the questionnaire.

Overall, 23 students out of the 60 that were invited participated in a focus group. Twenty-two students did not show up for their scheduled session and one student declined to participate after the researchers explained the purpose and procedures of the group. Some of the students who did not appear for their session were absent or told high school staff that they could not miss class because they had an exam. All 23 students who participated in the focus groups filled out the questionnaire at the end of the session.

Researchers made an audio recording of each focus group session and took written notes during the session. After each session, researchers typed up the written notes and reviewed the recording to capture any additional relevant information. When the six sessions were completed, researchers examined the notes for all six focus groups to identify themes in students' responses. In addition to identifying themes across the six groups, researchers also analyzed the notes to determine if there were patterns in students' responses based on achievement level and the junior high school they attended. Researchers also compiled students' responses to the brief questionnaire.

◆ Results

The study results related to teaching, student outcomes, and parents are reported in this section. The results detail numerous ways in which the laptop initiative may have had a positive influence on teaching and learning. The results of the study should not be used, however, as evidence of a causal relationship between the use of computers and laptops and changes in teaching and learning. Many other factors in addition to, or in place of, the use of computers and laptops may have affected the outcomes described in this report. To estimate the potential influence of other factors would have required the inclusion of a comparison school in the study design that was similar to both SJHS and OLJHS, but did not have laptops available to students. This type of design was not feasible within the scope of this study. Nonetheless, the study provides a detailed portrait of teaching and learning in a laptop environment.

When interpreting the study results it is important to keep in mind that data from the surveys and interviews were based on the self-report of students, teachers, and parents. As with any self-report measure in any study, people may have, intentionally or not, provided the response options that they thought would make them or their school look best. To reduce this possibility, teachers, students, and parents in this study completed the surveys anonymously. The evaluation design also included researcher observations of classroom instruction with computers or laptops to serve, in part, as a check against the possible bias of self-report. Although the scope of the information gathered through the classroom observations was not as broad as the scope of the student and teacher surveys or the teacher interviews, a qualitative comparison of the results among these data sources did not reveal any substantive differences that would suggest bias.

Teaching

This section describes the findings related to teaching and includes the following topics:

- Instructional behaviors;
- Content of the curriculum;
- Facilitation of students' higher order thinking; and
- Training and continuing professional development.

Instructional Behaviors

The study included three sources of information about how instructional behaviors might be affected by the use of laptops or computers: classroom observations, the teacher survey, and teacher interviews. During their classroom observations the researchers documented several characteristics of instruction by tracking the proportion of the following:

- class time spent on instruction/learning activities versus activities not related to instruction;
- instructional time spent in whole class work;

- instructional time spent in pairs/small group work; and
- instructional time spent in individual work.

Non-instructional activities were defined as housekeeping unrelated to the lesson or interruptions or other non-instructional activities, including behavior management and taking attendance⁵. As shown in Table 10, the proportion of time spent on activities that were not related to instruction was small at each school. The median value was 0% at SJHS and 4% at OLJHS.

Table 10. Proportion of class period spent on non-instructional activities, by school.

	SJHS (N=11)	OLJHS (N=12)
Median	0%	4%
Average	4%	5%
Range	0-20%	0-19%

At both schools, the most common type of instructional arrangement was whole class instruction (see Table 11). The median value for the proportion of instructional time spent in whole class instruction was 46% for SJHS and 49% at OLJHS. Median values for the pairs/small groups arrangement and individual arrangement were very small in comparison. There were no statistically significant differences between the schools for any of the lesson arrangements.

Table 11. Proportion of instructional time spent in each type of lesson arrangement, by school.

	SJHS (N=11)	OLJHS (N=12)
Whole Class Instruction		
Median	46%	49%
Average	53%	53%
Range	0-100%	0-100%
Pairs/Small Groups		
Median	0%	8%
Average	18%	20%
Range	0-100%	0-57%
Individuals		
Median	0%	5%
Average	29%	27%
Range	0-100%	0-84%

Researchers also rated the level of connections between classroom instruction and the world beyond the classroom (see Table 12). The most common level at both schools was level three,

⁵Horizon Research, Inc. (2000). Inside the Classroom: Observation and Analytic Profile, retrieved June 15, 2008 at <http://www.horizon-research.com/insidetheclassroom/instruments/obs.php>.

which was described as “Students study or work on a topic, problem or issue . . . connected to their personal experiences or actual contemporary public situations. Students recognize the connection between classroom knowledge and situations outside the classroom.”⁶ Differences between the schools were not statistically significant.

Table 12. Ratings on connections to the world beyond the classroom dimension of authentic instruction, by school.

	Number of SJHS Teachers	Number of OLJHS Teachers
Connections to the World Beyond the Classroom (SJHS N=10; OLJHS N=12)		
One	2	2
Two	2	3
Three	4	6
Four	2	1
Five	0	0

Ratings on the Integration Observation Rubric. The final area of the classroom observation protocol focused on how technology, specifically computers or laptops, was used in the classroom. As shown in Table 13, instruction in both schools was rated high on the degree to which students are focused on the intended curriculum objectives when using technology. The most common rating at both schools was a five on a five-point scale. Both schools also had high ratings in terms of how much the technology use represented learning activities that could not otherwise be easily done. Again, the most frequent rating at both schools was a five. Researchers also attempted to measure the degree of collaboration among students in group activities using technology. This dimension was dropped from the analysis, however, because during more than half of the observations the students either did not participate in any group activities or did not use technology during those activities.

⁶Ibid.

Table 13. Ratings on the integration observation rubric scales, by school.

	Number of SJHS Teachers	Number of OLJHS Teachers
Students are focused on intended curriculum objectives when using technology (SJHS N=11; OLJHS N=12)		
One	0 0%	0 0%
Two	0 0%	0 0%
Three	1 9%	1 8%
Four	3 27%	1 8%
Five	7 64%	10 83%
Technology use represents learning activities that could not otherwise be easily done (SJHS N=11; OLJHS N=12)		
One	0 0%	0 0%
Two	0 0%	0 0%
Three	1 9%	1 8%
Four	1 9%	3 25%
Five	9 82%	8 67%

Teacher survey. The teacher survey also provided information about how laptops or computers may affect instructional behaviors. One set of questions on the teacher survey focused on how teachers use their laptops to prepare or provide instruction. There was a statistically significant difference in the reported frequency of “managing student information” between SJHS teachers and OLJHS teachers. Sixty-one percent of SJHS teachers reported this activity “all the time,” 21% said “once a day” and 11% said “a few times a week,” compared to 51%, 3%, and 39% of OLJHS teachers, respectively. There were no significant differences on any of the other teacher tasks listed on the survey. Table 14 shows how the teachers from both schools responded to the questions. Across schools, the top four teacher behaviors with the laptops, as indicated by the highest percentage choosing “all the time”, were communicating with colleagues, managing student information, communicating with parents and students, and developing instructional materials (84%, 54%, 49%, and 39%, respectively).

Table 14. Frequency of teacher tasks on laptops.

Survey question: <i>“On average, how frequently do YOU perform the following tasks USING YOUR LAPTOP?”</i>	Never	Less than once a week	Once a week	A few times a week	Once a day	All the time
Conducting research that contributes to lesson plans and curriculum design	0%	12%	13%	34%	13%	28%
Developing instructional materials (handouts, tests, etc.)	0%	10%	8%	30%	13%	39%
Using presentation software for instructional purposes	5%	22%	12%	28%	5%	28%
Creating and/or maintaining website(s) for instructional purposes	6%	28%	21%	19%	18%	9%
Providing classroom instruction	4%	15%	6%	34%	9%	32%
Producing homework assignments	5%	27%	5%	27%	22%	15%
Assessing student work	6%	21%	16%	34%	10%	13%
Managing student information	2%	4%	3%	27%	10%	54%
Communicating with colleagues inside and outside the school	0%	3%	2%	5%	8%	84%
Communicating with parents and students	0%	6%	3%	34%	9%	49%

Another set of questions on the survey asked teachers how their students used computers or laptops during classroom instruction. There were statistically significant differences in teacher responses between the schools on several items (See Table 15). Eighty-eight percent of SJHS teachers reported that students in their classrooms took notes on a computer “never” or “less than once a week” while 69% of OLJHS teachers reported that their students took notes on a computer once a week or more. Also, significantly different between schools was the frequency of students publishing content to the web; 54% of OLJHS teachers said students never did this, compared to only 15% of SJHS teachers. Another significant difference between schools was found in the frequency of students “creating culminating projects to show what they have learned (web pages, multimedia projects, videos, etc.)”. Surprisingly, 4% of teachers at SJHS reported that students never engaged in these projects compared to 38% of OLJHS teachers, and 26% of teachers at SJHS said students created projects once a week or more, compared to only 15% of OLJHS teachers. Another interesting pattern existed between the schools in teachers’ perceptions of students’ email use. Although the difference was not statistically significant, 63% of SJHS teachers indicated that students never send or receive email in their classrooms, compared to 35% of OLJHS teachers.

Table 15. Students' tasks on computers or laptops during classroom instruction, by school.

Survey question: <i>"When STUDENTS have access to COMPUTERS or LAPTOPS in your classroom, how often do they do the following?"</i>	Never	Less than once a week	Once a week	A few times a week	Once a day	All the time
Taking notes on the computer.*						
SJHS	44%	44%	7%	4%	0%	0%
OLJHS	13%	18%	8%	28%	15%	18%
Publishing content to the web as part of ongoing student work.*						
SJHS	15%	56%	22%	7%	0%	0%
OLJHS	54%	31%	8%	5%	0%	3%
Creating culminating projects to show what they have learned (web pages, multimedia projects, videos, etc.).*						
SJHS	4%	69%	14%	4%	8%	0%
OLJHS	38%	48%	0%	15%	0%	0%
Sending/receiving email.						
SJHS	63%	19%	7%	4%	0%	7%
OLJHS	35%	20%	5%	23%	3%	15%

*Indicates significant difference between schools at the .05 level in responses to this question.

There were no statistically significant differences between SJHS teachers and OLJHS teachers concerning other tasks listed in Table 15 that students may have done when they had access to computers or laptops in the classroom. The combined results are shown in Table 16. The most frequent ways that students used their computers or laptops for classroom instruction, as indicated by the percent that did this a few times a week or more, were: managing and analyzing information (49%), researching information using the Internet (44%), and working on short-term assignments/worksheets (42%). In contrast, 42% of the teachers said they never had students work with spreadsheets/databases. Over one-third of the teachers indicated that they never have students take tests/quizzes when students have access to computers or laptops in the classroom.

Table 16. Students' tasks on computers or laptops during classroom instruction.

Survey question: <i>"When STUDENTS have access to COMPUTERS or LAPTOPS in your classroom, how often do they do the following?"</i>	Never	Less than once a week	Once a week	A few times a week	Once a day	All the time
Writing first drafts of papers	28%	42%	15%	13%	0%	2%
Editing papers	27%	44%	16%	11%	2%	2%
Working with spreadsheets/databases	42%	45%	8%	5%	0%	2%
Managing/analyzing information	10%	28%	12%	28%	9%	12%
Researching information using the Internet	5%	24%	27%	27%	6%	11%
Taking test/quizzes	36%	41%	14%	8%	0%	2%
Doing drills to increase their competency (educational drill software, online quizzes, Quia, FunBrain, etc.)	22%	33%	15%	16%	6%	8%
Working on short-term assignments/worksheets	9%	34%	15%	24%	12%	6%

In response to the statement, "When I know that my students will have access to computers or laptops I am better able to individualize my curriculum to fit student needs," 90% of OLJHS teachers agreed compared to 81% of SJHS teachers (see Table 17). The difference between schools on this item was statistically significant when all levels of agreement were included in analysis. OLJHS teachers were also significantly more likely to agree that they were able to cover more material in class when students use computers or laptops. Seventy-nine percent of OLJHS teachers agreed with the statement, compared to 67% of SJHS teachers.

Table 17. Students' tasks on computers or laptops during classroom instruction, by school.

Survey question: <i>"Indicate how much you agree or disagree with each of the following statements about TEACHERS and TEACHING:"</i>	Disagree	Agree
When I know that my students will have access to computers or laptops I am better able to individualize my curriculum to fit student needs.*		
SJHS	19%	81%
OLJHS	10%	90%
When students use computers or laptops I am able to cover more material in class.*		
SJHS	33%	67%
OLJHS	21%	79%

*Indicates significant difference between schools at the .05 level in responses to this question.

Results from additional questions about teachers' opinions about computers or laptops in the classroom show a generally positive response (See Table 18). Eighty-eight percent of teachers in both schools disagree with the statement "the presence of computers or laptops in my classroom is disruptive to my teaching" and 69% disagree with the statement "given computer or laptop problems such as freezing or an inability to access the Internet, I have to create two lesson plans for everything I do." Ninety-one percent of teachers agree that a laptop helps them to access more up-to-date information for their students, 90% of teachers agree that through the use of computers or laptops students are able to explore topics in greater depth, and 90% of teachers agree that having computers or laptops in the classroom helped them create materials that better meet district goals. In addition, 67% agree that there is less classroom management needed when students are using computers or laptops in the classroom.

Table 18. Teachers' responses about teaching and the teaching environment with computers and laptops.

Survey question: <i>"Indicate how much you agree or disagree with each of the following statements about TEACHERS and TEACHING:"</i>	Disagree	Agree
Having a laptop has helped me to access more up-to-date information for my students.	9%	91%
When we are using computers or laptops in class there is less classroom management that needs to take place.	33%	67%
Using computers or laptops in the classroom has increased my workload.	49%	51%
The presence of computers or laptops in my classrooms is disruptive to my teaching.	88%	12%
Knowing my students will have access to computers or laptops in the classroom helps me create instructional materials that better meet the district goals for student learning.	10%	90%
Given computer or laptop problems such as freezing or an inability to access the Internet, I have to create two lesson plans for everything I do.	69%	31%
Students are able to explore topics in greater depth when they use computers or laptops.	10%	90%

Teachers at SJHS and OLJHS had similar responses to two questions about teaching philosophy. Each of the survey items contained two quotes about what makes instruction effective. Teachers were asked to choose a number from 1 to 7 that indicated how close their beliefs were to a particular statement (See Table 19). The average rating for the first pair, for teachers from both schools combined, was 3.56 and the median was a bit higher at 4.0. This suggests that teachers see their philosophy as incorporating roughly equal parts of each statement. The average rating for the second pair was slightly higher at 4.54 and the median was 5.0. This implies that the teachers' philosophies tend to emphasize 'sense-making' and student thinking rather than the content of the curriculum.

Table 19. Teachers' beliefs about effective instruction.

Survey question: "Different teachers have different teaching philosophies. For the following pairs of statements below, select the number that best shows how close your beliefs are to each of the statements in a given pair. The closer your beliefs are to a particular statement, the closer the number you should select from the drop-down menu below."		
I mainly see my role as a facilitator. I try to provide opportunities and resources for my students to discover or construct concepts for themselves.	1 2 3 4 5 6 7	Students really won't learn the subject unless you go over the material in a structured way. It's my job to explain and to show the students how to do the work and to assign specific projects.
Mean = 3.56	Median = 4.0	Standard deviation = 1.408
The most important part of instruction is the content of the curriculum. That content is what children need to know and be able to do.	1 2 3 4 5 6 7	The most important part of instruction is that it encourages 'sense-making' or thinking among students. Content is 'secondary'.
Mean = 4.54	Median = 5.0	Standard deviation = 1.202

Teachers at both schools tended to exchange emails frequently with parents and the differences were not statistically significant (see Table 20). Thirty-nine percent of SJHS teachers exchanged emails with parents a few times a week, and 54% emailed parents every school day, compared to 53% and 38% of OLJHS teachers, respectively. In addition, 67% of SJHS teachers placed student assignments online a few times a week or more, and 83% of OLJHS teachers did the same. These differences were not statistically significant.

Table 20. Frequency of teacher contact with parents and online placement of assignments, by school.

Survey question: "How often do you exchange emails with parents of students?"	Less often than a few times a year	A few times a year	A few times a month	A few times a week	Every school day
SJHS	0%	7%	0%	39%	54%
OLJHS	0%	0%	10%	53%	38%
Survey question: "How often do you place student assignments/homework on the web or a server location accessible to students?"	Less often than a few times a year	A few times a year	A few times a month	A few times a week	Every school day
SJHS	11%	4%	18%	21%	46%
OLJHS	0%	8%	10%	30%	53%

Teachers' responses to several survey items also illustrated how much students' classroom access to computers or laptops contributed to their learning. Over two-thirds (71%) of the SJHS teachers, in contrast to 38% of the OLJHS teachers, chose "A lot" in response to the statement "Students are more interested in class" (See Table 21). Over half of the OLJHS teachers,

however, said access contributed “Some” to students’ interest in class. The differences between the schools were statistically significant. One possible explanation for this difference is that because the laptops were always present in classrooms at OLJHS, their presence had less of a novelty effect for students than at SJHS where the intermittent use of laptops or computers in the classroom had more influence on students’ interest level.

Table 21. Teachers’ perceptions of the contributions of students’ classroom access to computers or laptops, by school.

Survey question: “How much does students’ access to a computer or laptop in their classroom contribute to each of the following areas?”	Not at all	Very little	Some	A lot
Students are more interested in class.*				
SJHS	7%	7%	14%	71%
OLJHS	8%	3%	53%	38%

*Indicates significant difference between schools at the .05 level in responses to this question.

There were no significant differences in how SJHS teachers and OLJHS teachers responded to items about other aspects of student learning. As shown in Table 22, over half of the teachers said students’ classroom access to computers or laptops contributed “A lot” to the following aspects of their learning:

- Students’ level of engagement increases (66%).
- Students explore topics in greater depth (53%).
- Students help each other more (52%).

Over half of the teachers indicated that classroom access to computers or laptops contributed “Some” to these aspects of their learning:

- Students’ rate of homework completion increases (66%).
- Students’ work habits and self-discipline improves (60%).
- Students work harder at their assignments (57%).
- Students’ overall quality of work is better (54%).

Table 22. Teachers' perceptions of the contributions of students' classroom access to computers or laptops.

Survey question: "How much does students' access to a computer or laptop in their classroom contribute to each of the following areas?"	Not at all	Very little	Some	A lot
Students spend more time giving presentations.	25%	12%	50%	13%
Students help other students more.	6%	3%	39%	52%
Students explore topics in greater depth.	4%	4%	38%	53%
Students take more initiative on classwork/projects outside of class time.	6%	8%	45%	42%
Students' writing quality improves.	9%	24%	47%	21%
Students' overall quality of work is better.	4%	9%	54%	32%
Students work harder at their assignments.	7%	7%	57%	28%
Students revise their work more.	8%	16%	37%	39%
Students' level of engagement increases.	6%	5%	24%	66%
Students' work habits and self-discipline improve.	9%	9%	60%	22%
Students' pride and ownership in their work products increases.	6%	6%	49%	39%
Students' rate of homework completion increases.	12%	10%	66%	12%

Tables 23 and 24 show teachers' responses to a second set of items regarding how students are affected by computers or laptops in the classroom. A large proportion of the teachers from each school reported some level of agreement with this statement. Ninety percent of the OLJHS teachers and 71% of the SJHS teachers agreed that open communication is high with computers or laptops in the classrooms; teachers from OLJHS had a significantly higher percentage of agreement.

Table 23. Teachers' perceptions of student outcomes in relation to computers or laptops, by school.

Survey question: "Indicate how much you agree or disagree with each of the following statements:"	Disagree	Agree
There is more open communication between students and teachers in the classrooms when computers or laptops are in use.*		
SJHS	29%	71%
OLJHS	10%	90%

*Indicates significant difference between schools at the .05 level in responses to this question.

There were no significant differences between SJHS and OLJHS teachers on any of the other items regarding student outcomes. Over three-fourths of the teachers indicated some level of agreement (strongly agree, agree, somewhat agree) with the following statements (see Table 24):

- Students in my classroom are more actively involved in learning when we use computers or laptops (91%).
- My students show greater engagement in the task when they are using computers or laptops (90%)

- My students are more organized when they use a computer or laptop (88%).
- The quality of my students' work increases when we use computers or laptops (85%).
- Computers or laptops allow my students to get their work done more quickly (81%).
- Students in my classroom do more work when they are using computers or laptops (79%).
- My students are more apt to revise/edit their work when it is done using computers or laptops (79%).

Almost half of the teachers (49%) indicated agreement (strongly agree, agree, somewhat agree) with the statement "The surplus of information on the Internet makes it difficult for my students to focus on their work." This suggests that one challenge for teachers when students are using computers or laptops for research on the Internet is helping students develop the skills needed to maintain a focus on their work despite the numerous distractions they encounter on the Internet.

Table 24. Teachers' perceptions of student outcomes in relation to computers or laptops.

Survey question: <i>"Indicate how much you agree or disagree with each of the following statements:"</i>	Disagree	Agree
Students in my classroom are more actively involved in learning when we use computers or laptops.	9%	91%
Students in my classroom do more work when they are using computers or laptops.	21%	79%
My students are more apt to revise/edit their work when it is done using computers or laptops.	21%	79%
The surplus of information on the Internet makes it difficult for my students to focus on their work.	51%	49%
Computers or laptops allow my students to get their work done more quickly.	19%	81%
The quality of my students' work increases when we use computers or laptops.	15%	85%
My students are more organized when they use a computer or laptop.	12%	88%
My students show greater engagement in the task when they are using computers or laptops.	10%	90%
Communication between students in the classroom is greater when computers or laptops are in use.	26%	74%

Teacher Interviews. During interviews with teachers the researchers asked the teachers to think about how their teaching may have changed since the laptop initiative began.

Initial Reactions. When asked to look back to the time when they first got their laptop and began thinking about how students might use their laptops, teachers at both schools were most likely to report that their reaction had been positive. Representative comments were as follows:

I thought they would be pretty useful in doing general research because students like to use computers more than library resources so I thought it would be an interesting thing to do.

That it would fit well. Prior to getting laptops we had a cart of laptops and I would reserve those every once in a while and have students do something on them when I could. I was excited to have them on a daily basis rather than having to plan something for maybe once a month when I could get the cart.

Two teachers recalled that they were concerned upon hearing about the laptop initiative. In both cases, their concern centered on how much they thought they would have to learn about using the laptops. As one teacher said, *"I was very afraid and nervous. I wasn't critical out loud, but I was scared."* Another teacher recalled a mixed reaction,

I was scared about how I was going to learn so much to get them to use them correctly and to the best of their ability. I was excited about teaching social studies and the information I could get to them, more up-to-date information.

Biggest Change in Instruction or Beliefs. Teachers were asked to recall what may have been the biggest change for them, since the laptop initiative began, in terms of their instruction or their beliefs about instruction. In their replies, teachers described a range of changes. Most common, as mentioned by four teachers, was how teachers' increased access to information made their instruction more up-to-date and thus more interesting for students. Laptops also made it easier for teachers to adapt their lesson plans. Some representative comments were as follows:

Things are a lot more current. . . . It is far more interesting and interactive for them.

I can look something up while they take a test instead of going to the library. There hasn't been a semester yet where things haven't changed [in lesson plans]. Before I would make changes [from year to year], but I couldn't do it as quickly because it wasn't at my desk so I couldn't do it in the classroom.

One teacher noted how quickly textbooks become out of date: *"The textbook is online but last year I used it only four times. We're already past one of those times this year [and did not use text]. The content changes too fast. By the time the text is published and chosen for purchase it is out of date."* The teacher then described how he⁷ was now able to access more up-to-date information online and thus was less reliant on the textbook. For example,

I teach things much more real time, real world. When the tsunami hit I sent kids to different islands in the area and looked at the second wave of death from bacterial and viral infections; that's what we were studying at the time. What's going on? What should we do? It allowed me to connect it to their worlds, to what they're hearing about in the news.

⁷ For ease of reading, the pronoun "he" is used throughout this report, regardless of whether the speaker was male or female.

Another teacher described how he kept lesson plans flexible and let student interest guide what happens in the classroom. *"I treat my lessons as a guide rather than 'what we're doing today.' They have great ideas and sometimes we'll do them. I've learned to be flexible and expect that they'll ask [if they want to do something different]."* Two teachers mentioned that it was easier to differentiate instruction when students have laptops. As one of them remarked, *"[Without laptops] you don't have time to differentiate or have individual meetings with students; you just teach to the middle."*

One English language arts teacher noted that he assigned more writing and could more easily give students feedback, now that students typed their papers and submitted them electronically. Another teacher felt the biggest change was that having a laptop helped him be more organized because he could have options for learning activities available from his public folder or laptop. In that way, if something wasn't working in class or they needed to spend more time on a concept from the previous day, they could easily access the needed materials electronically.

The teachers were less likely to describe changes in their *beliefs* about effective instructional practice. Four teachers remarked on their recognition of the importance of including technology in their lessons to enhance students' interest. As one of them told the interviewer,

I didn't expect coming out of grad school that it would be so focused on technology. It's definitely a trigger, an interest for them; anytime they are able to use technology they are interested. The need to have something with technology built into your class, creating that opportunity to show off their skills and use technology.

Three mentioned that their beliefs had changed regarding the value of lecturing, the value of the teacher being up front. Another teacher reflected on the change in his original concern that using the laptops would be an add-on to regular instruction rather than an integral part of that instruction. Finally, one teacher said he was uncertain whether his beliefs had changed at all.

During the interview the researcher also asked teachers to reflect on how much having laptops may have influenced their instruction in four specific areas:

- How much their instruction is student-centered versus the teacher being the dispenser of knowledge.
- How much their instruction includes giving students opportunity to actively explore information versus passively accepting it.
- How much their instruction includes students doing critical thinking versus factual recall.
- How much their instruction includes giving students multiple opportunities to collaborate.

Student-Centered Instruction. The teachers enthusiastically described how their instruction had become more student-centered during the laptop initiative. With the exception of one teacher

who didn't note any change in this area, each teacher offered ready examples of the shift away from being a "sage on the stage." Representative comments were as follows:

Absolutely 100%. I don't lecture anymore. I give instruction and guidance for no more than 10 minutes at the start of class. . . . Prior it was a lot of worksheets and textbook reading and answer the questions at the end. Now there is a lot of exploration and it is based on their interests. We still have to do the standards but they can tailor it more to their interests. They get more involved because it is something interesting and they have a choice.

We do a claymation lab and teach each other the names and characteristics of living things through claymation. That's fun. The kids' work is very self-guided.

My teaching in the last four years has changed 75%. I'm a different type of teacher. I talk less and they do more. I'm a facilitator more than presenter.

Several of the teachers noted that they had long sought to make their instruction more student-centered and the addition of the student laptops made it easier to do. As one teacher explained,

I've always tried to put a lot of learning on the shoulder of the kids; it's been a long time since I've been a sage on the stage. I've always had a student-centered classroom; the laptops didn't make it more so, but it made it more effective for students. I've always tried to get kids involved in talking in small groups rather than just telling them what they're learning, but they're better at it when they have more resources at their fingertips.

Active Exploration. Closely-related to changes in student-centered learning were shifts in how often teachers provided students with more opportunities to actively explore information rather than just passively accepting it. Most of the teachers reflected on how students' use of computers or laptops had made it easier to ask students to explore information. Some representative examples follow.

Certainly, because it's so much easier to ask students to be responsible for constructing information. Their assignment is to write instructions for how to write a thesis paper. I told them I'm not going to lecture about this; if you don't know it do Google or find it yourself. I am much more able to put the onus on them.

Every day they do some exploring or just playing around with different things. Before, unless I had hand-held manipulatives for everyone, we really didn't do it. When we do a web activity from the book there are all kinds of side links so students can explore more if they're interested. Before you couldn't do that. Five, ten years ago the best we could do was wheel in a cart of books from the library.

Only two teachers did not endorse this view. One recalled that students have always been asked to explore information in her courses. A second teacher said this aspect of her/his practice had not changed much.

Critical Thinking. All of the teachers noticed a shift in how much they asked students to do critical thinking rather than recall facts they had memorized. Several teachers noted that students were still required to recall some factual information in their courses. The laptop initiative had not eliminated the need for students to know some facts, but, instead, had expanded the options for students to discover and explore information on their own. In a few cases, the teachers said they did critical thinking before but laptops made it easier and/or they did it more frequently with laptops. Comments that illustrate these points are as follows:

Just about everything we do with geography is critical thinking because we're really looking for patterns and reasons behind those patterns and implications of those patterns. I think our whole curriculum focuses on critical thinking. With the laptops it opens up many more possibilities for us.

In most of my projects and assessments I think they're doing more of applying the knowledge to original projects. . . . Rather than giving them a test I watch them use it.

In teaching literature we talk about plot and conflict and things like that and without a computer you would have some lecture and discussion and a worksheet. With computers we tend to take these low level things like plot and context and use it as a basis to develop an essay about theme. They use Inspiration and they do a synthesis piece.

Depending on what I'm using them [laptops] for. We do a lot of web quests; I come up with a series of questions about whatever country we're studying and they have to go online and find the information and once they find it they need to dive in and make an opinion.

Student Collaboration. Of the four specific changes included in the interview protocol, teachers were least likely to report change in how often students work together on learning activities. Three teachers said they had done small group work before the laptop initiative, but students were more likely to do collaborative work with the laptops. As one teacher explained,

In the past I did two or three a year; with the laptops I'll do 10 small group projects a year. Access to the Internet and information puts us in a position where they go out and get information and apply it. You've got part of a group on the research, part working on presentation, and part looking for this information. We didn't have that when you went down to the media center to pull books.

Another teacher described how technology made collaboration easier for students: “*This way I can open a SharePoint on my computer and they can work on Keynote together; [they] bring their work together to form one project.*” The need to share equipment, such as digital cameras

or video recorders, or even the classroom laptops at SJHS, on occasion, also stimulated student collaboration.

Influence of Technology Versus Teachers' Beliefs. Next, the interviewer asked teachers to consider 1) how much the introduction of laptops might change teachers' beliefs about what effective instruction looks like, and 2) how likely it was that the teachers who changed their practice the most tended to be those teachers whose beliefs were already consistent with practices emphasized in laptop initiatives. On this question teachers were asked to reflect on their own experiences and what they had observed among their peers.

Three teachers cited examples of fellow teachers who became strong users even though they initially had been against the laptops, or at least hesitant about adding the laptops. More often, however, the teachers thought that the extent to which a teacher's philosophy was consistent with laptop use and a teacher's comfort with technology were factors to some extent in how much a teacher ultimately integrated laptops into their instruction. As one teacher explained, *"There are a few whose philosophy hasn't changed dramatically, but they are using the laptops a little. . . . The ones I know who use it a lot are those whose philosophy is a fit. With any tool, the way you use it has to do with the way you are."*

Three teachers mentioned how the experience of seeing what their students could do with laptops was powerful in changing teachers' views of laptops. One teacher remarked, *"Even of those who came to it more reluctantly I would say 90% have been won over by student engagement, creativity, organization and those things we like about it."* Two teachers mentioned the importance of having a technology person on staff to support teachers who may be more hesitant to try integrating laptops into their instruction. As one of them noted, *"I think that people who are good at it are obviously more excited about it. I would not have been good at it and my tech person has been very supportive. Some of the stuff I probably wouldn't have done without that support."*

Differences Between Laptop Initiative Models. Although the researcher did not specifically ask teachers to compare the cart model and the one-to-one model of laptop access for students, several SJHS teachers commented on the potential differences. Three teachers described some challenges of the cart model.

I do think it would be helpful if we knew that every kid had one. There are many times that I'm thinking, "Oh, that would be a really good idea to use the laptops," but I know when I go to look up if they're available that they're all booked up. A lot of times that's how teachers do it; they see what kids are struggling with and change the lesson. And so you have to leave yourself a note to change it next time, and the teachers email each other to see if they can reserve the cart. So, you think you're going to use it Monday and then they didn't get as far as you thought they would. Really, I think the cart system is okay because then the kids care for the computers, but having the carts means there isn't as much impromptu planning or use.

One of the limitations [of students collaborating on projects] from outside school is Internet access. They'll start something at school and theoretically they have access to the server from outside of school, but it's hard to get access.

One wonderful thing about one-on-one, as long as a student has an Internet connection at home, you can give them homework for a particular project [because they have access to the same software at home and at school]. Because of carts I'm limited on homework. [Asking kids to do homework that requires] Internet is okay, but things that use special software I can't assign as homework because I can't assume families have it at home. They can transfer the file they created in class, but if they don't have the same software at home, then they can't open it. We've had to be creative about that, allowing more time in class for certain things. There is some good in this because then I'm with them when they're working.

In contrast, the comments of two other teachers suggest they are comfortable with the cart model.

I feel like, for the most part, when I need a cart I can get it. I'm a planner, so maybe that's why. I've been able to get them when I want them. . . . I don't feel like we've been hurt by not being one to one. Being a math teacher I feel like kids just need that paper and pencil to do problem solving. . . . I can take them somewhere on the SmartBoard even if they don't have their own [laptop].

But if they have [carts] at least 75% of the student's day then we're exciting them. They don't need to have it in their full day. So what if they have one period that they don't use a computer?

Content of the Curriculum

With regard to embedding laptop use into the curriculum, a few survey questions addressed the ways in which teachers have made changes to accommodate the laptops (see Table 25). In response to the statement "When I know my students will have access to computers or laptops I am better able to access diverse teaching materials and resources for my students," 94% of all teachers indicated agreement. In addition, teachers report increased use of online materials during instruction: 90% agreed with this statement. In addition, 84% of teachers agree to the statement "I am better able to meet my curriculum goals when students are using computers or laptops." There was no significant difference between schools on these items.

Table 25. Curriculum content and laptop or computer access.

Survey question: <i>“Indicate how much you agree or disagree with each of the following statements about TEACHERS and TEACHING:”</i>	Disagree	Agree
When I know my students will have access to computers or laptops I am better able to access diverse teaching materials and resources for my students.	6%	94%
Knowing my students have access to computers or laptops has increased my use of online materials during instruction.	10%	90%
I am better able to meet my curriculum goals when students are using computers or laptops.	16%	84%

Facilitation of Students’ Higher Order Thinking

One district expectation of making laptops/computers available in the classroom was that it would be easier for teachers to include higher order thinking as part of instruction. One item on the teacher survey addressed this area and 22% of teachers said students’ access to computers or laptops in the classroom contributed a lot to “Students demonstrate higher order thinking” (see Table 26). Over half of the teachers said it contributed some (62%). The difference between schools was not significant.

Table 26. Teacher perceptions of the contributions of student classroom access to computers to teacher ability to facilitate higher order thinking.

Survey question: <i>“How much does students’ access to a computer or laptop in their classroom contribute to each of the following areas?”</i>	Not at all	Very little	Some	A lot
Students demonstrate more higher-order thinking.	7%	9%	62%	22%

As part of the classroom observations at both schools the researchers rated the level of higher order thinking taking place in the learning activities. Higher order thinking (HOT) was defined on the observation tool as instruction that “involves students manipulating information and ideas by synthesizing, generalizing, explaining, hypothesizing, or arriving at conclusions that produce new meanings and understandings for them.”⁸ Typically, at both schools, the level of higher order thinking required of students during instruction was high (see Table 27). The most common rating at each school was level four, defined as “Students are engaged in at least one major activity, which occupies a substantial portion of the lesson, in which many students are performing HOT operations.”⁹

⁸ Newmann, F. M. , Secada, W.G., and Wehlage, G.G. (1995). A Guide to Authentic Instruction and Assessment: Vision, Standards, and Scoring. Madison, WI: Wisconsin Center for Education Research, University of Wisconsin.

⁹ Ibid.

Both schools were also rated high on the level of deep knowledge addressed through instruction. The rubric defined this dimension as “Instruction addresses central ideas of a discipline or topic with enough thoroughness to explore connections and relationships and to produce relatively complex understandings.”¹⁰ Although the differences between the schools were not statistically significant, the most common level at SJHS was a 3 and the most common level at OLJHS was a 4. These levels were defined as follows:

Level Four: Knowledge is relatively deep. Either the teacher or the students provide information, arguments, or reasoning that demonstrates the complexity of an important idea.

Level Three: Knowledge is treated unevenly during instruction, i.e., deep understanding of something is countered by superficial understanding of other ideas.

Table 27. Ratings on the higher order thinking and deep knowledge dimensions of authentic instruction, by school.

	Number of SJHS Teachers	Number of OLJHS Teachers
Higher Order Thinking (SJHS N=10; OLJHS N=12)		
One	0	2
Two	1	2
Three	2	2
Four	6	5
Five	1	1
Deep Knowledge (SJHS N=10; OLJHS N=12)		
One	0	1
Two	2	3
Three	5	2
Four	2	6
Five	1	0

Training and Continuing Professional Development

The teacher survey contained several items related to teachers’ continuing professional development. As described earlier, both schools continue to offer teachers opportunities to deepen their knowledge and skills in using various types of software in the classroom and the district offers a day of professional development each February. The survey questions were designed to reflect the professional development approach in the district which emphasizes job-embedded staff development and peer-to-peer learning rather than teachers attending workshops off-site.

¹⁰ Ibid.

The types of professional development teachers reported were similar at both schools. The only significant difference was on the item “Had colleagues observe your classroom when you’re integrating computers or laptops” (see Table 28). Sixty-three percent of OLJHS teachers had done this at least 1-2 times during the year in contrast to 54% of SJHS teachers. Almost one-fourth of the OLJHS teachers had done this 6 or more times during the year. There was no difference between the schools when teachers were asked if they had visited another teacher’s classroom to observe instruction when they are integrating computers or laptops. Over half of the OLJHS teachers and over one-third of the SJHS teachers had never visited another teacher’s classroom to observe instruction when they are integrating computers or laptops. Given the high proportion of OLJHS teachers who said they had had a colleague observe their instruction, it is surprising that so few have in turn observed another teacher’s instruction. One possible explanation is that the OLJHS teachers included visits by external people, such as teachers and administrators from schools considering the one-to-one model, in selecting their response for this item.

Table 28. Frequency of teacher interactions with colleagues, by school.

Survey question: “How often in this school year have you...”	Never	1-2 times	3-5 times	6-9 times	10-15 times	More than 15 times
Had colleagues observe your classroom when you’re integrating computers or laptops?*						
SJHS	46%	43%	11%	0%	0%	0%
OLJHS	38%	20%	20%	13%	10%	0%
Visited other teachers’ classrooms to observe instruction when they are integrating computers or laptops?						
SJHS	39%	39%	14%	4%	4%	0%
OLJHS	53%	18%	11%	13%	3%	3%

*Indicates significant difference between schools at the .05 level in responses to this question.

Table 29 shows teachers’ reports on the other ways they interacted with colleagues during the past year. The most common form of interaction was teachers exchanging suggestions with colleagues about integrating computers or laptops into instruction. Only 4% had never done this and 40% had done it 15 or more times during the year. Teachers reported that conversations with colleagues about developing new curriculum that integrates computers or laptops were also common. Only 7% had never done this and over one-fourth said they had talked with colleagues about new curriculum more than 15 times during the year.

Table 29. Frequency of teacher interactions with colleagues.

Survey question: <i>“How often in this school year have you...”</i>	Never	1-2 times	3-5 times	6-9 times	10-15 times	More than 15 times
Exchanged suggestions with colleagues about integrating computers or laptops into instruction?	4%	6%	13%	18%	19%	40%
Had conversations with colleagues about the development of new curriculum that integrates computers or laptops?	7%	7%	16%	12%	29%	28%
Had conversations with colleagues about managing classroom behavior when students are using computers or laptops?	15%	16%	19%	21%	16%	13%
Invited someone in to help teach your classes when you’re integrating computers or laptops?	62%	22%	9%	4%	3%	0%
Received meaningful feedback on your integration of computers or laptops from colleagues?	28%	19%	37%	7%	4%	4%
Visited other teachers’ classrooms to observe instruction when they are integrating computers or laptops?	47%	27%	12%	9%	3%	2%

There were no significant differences between the schools in terms of how often teachers discussed their professional development experiences with other teachers or administrators, or in how often they made changes in their teaching practice. Teachers were more likely to discuss what they had learned with other teachers who did not attend the professional development activity than with administrators (see Table 30). Only 8% selected the response option “Not at all” when asked about discussions with other teachers; in contrast, over one-third selected this option when asked about discussions with administrators. Almost one-third of the teachers said that most of the time they had discussions with other teachers and 16% said they had discussions every time they returned from a professional development activity.

Table 30. Teachers’ response to professional development.

Survey question: <i>“After attending professional development activities on technology integration this past year, did you:”</i>	Not at all	Sometimes	Most of the time	Every time
Discuss what you learned with other teachers in your school who did not attend the activity?	8%	44%	31%	16%
Discuss or share what you learned with administrators?	35%	46%	12%	7%
Make changes in your teaching practice?	9%	51%	28%	12%

Teachers' perceptions of administrative support for professional development were similar for both schools with the exception of two areas (see Table 31). All (100%) of the teachers at SJHS that took the survey indicated that they agreed with the statement "The technology coordinator in my school has assisted me in finding ways to integrate computers or laptops with my curriculum" in contrast to 90% of the OLJHS teachers. Teachers at SJHS were also more likely to agree with the statement "The administrators in my school have provided opportunities for teachers to engage in professional development activities regarding the laptops." Ninety-six percent of the SJHS teachers agreed with this statement, compared to 90% of OLJHS teachers.

Table 31. Teachers' perception of administrative supports for professional development, by school.

Survey question: <i>"Indicate how much you agree or disagree with each of the following statements about supports in technology implementation."</i>	Disagree	Agree
The technology coordinator in my school has assisted me in finding ways to integrate computers or laptops with my curriculum.*		
SJHS	0%	100%
OLJHS	10%	90%
The administrators in my school have provided opportunities for teachers to engage in professional development activities regarding the laptops.*		
SJHS	4%	96%
OLJHS	10%	90%

*Indicates significant difference between schools at the .05 level in responses to this question.

For many aspects of administrative supports for professional development, however, there were no statistically significant differences in how teachers responded to the questions. Nearly all (93%) strongly agreed that they wished they had more time during the day to explore using computers and laptops effectively in their classroom (see Table 32). Ninety-four percent agreed with the statement "The administrators in my school actively encourage me to pursue professional development activities geared toward implementing computers or laptops into the curriculum." This statement is quite similar to another statement on the survey for which there were significant differences in how teachers responded between the schools. The major distinction between the items is that one refers to administrators providing opportunities for professional development and the other item refers to administrators providing encouragement. Based on the survey results, teachers at both schools think their administrators provide encouragement, but teachers at SJHS are significantly more likely to report that their administrators provide opportunities for professional development.

Table 32. Teachers' perception of administrative supports for professional development.

Survey question: <i>"Indicate how much you agree or disagree with each of the following statements about supports in technology implementation."</i>	Disagree	Agree
The administrators in my school actively encourage me to pursue professional development activities geared toward implementing computers or laptops into the curriculum.	6%	94%
It is difficult for me to leave school to attend professional development workshops related to computers or laptops.	50%	50%
Apple personnel have assisted me in locating information and answering questions regarding computers or laptops.	49%	51%
I wish I had more time during the day to explore using computers or laptops effectively in my classroom.	7%	93%

Student Outcomes

This section describes the findings for the four types of student outcomes included in the study. The outcomes were as follows:

- Student-teacher and student-student communication;
- Opinions about the use of laptops;
- On-task classroom behavior and student engagement; and
- Student achievement.

Student-Teacher and Student-Student Communication

One aim of the laptop initiative was to facilitate communication between teachers and students, both during the school day and outside of the school day. As shown in Table 33, a majority of the students at each school indicated that when they have access to a computer or laptop they communicated about the same amount with their teachers during school as they did prior to the introduction of the laptops (60% and 61% for SJHS and OLJHS, respectively). In contrast, about one-third of the students at each school said when they were home they communicated more with teachers than they did previously (34% and 30%, SJHS and OLJHS, respectively).

The district had also hoped the initiative would increase student-student communication and facilitate students' collaborative learning experiences. Over half of the students at OLJHS (52%) and 44% of the students at SJHS said when they had access to a computer or laptop at school they communicated with other students about the same amount (See Table 10). When asked about communication with other students when they were at home; however, 50% and 53% of the students, at OLJHS and SJHS, respectively, reported that they communicated more.

Table 33. Student-teacher and student-student communication.

<u>Survey question</u>	More	Less	About the same amount
When I have access to a computer or laptop at school, I interact with my teacher's ___? ___ during school.			
SJHS	22%	19%	60%
OLJHS	19%	21%	61%
When I have access to a computer or laptop at home, I interact with my teacher's ___? ___ when I am at home.			
SJHS	34%	29%	37%
OLJHS	30%	32%	38%
When I have access to a computer or laptop at school I interact ___? ___ with other students during school.			
SJHS	39%	17%	44%
OLJHS	36%	12%	52%
When I have access to a computer or laptop at home, I interact ___? ___ with other students about school projects and assignments when I'm at home.			
SJHS	50%	18%	32%
OLJHS	53%	14%	33%

The classroom observation protocol also collected information about student-teacher and student-student communication. During their classroom visits the researchers rated the level of substantive conversation among students and between students and the teacher. Substantive conversation was defined as follows on the observation protocol:

Students engage in extended conversational exchanges with the teacher and/or their peers about subject matter in a way that builds an improved and shared understanding of ideas or topics. 1) The talk is about subject matter in the discipline and includes higher order thinking. 2) The conversation involves sharing of ideas—participants explain themselves or ask questions in complete sentences, and when they respond directly to comments of previous speakers. 3) The dialogue builds coherently on participants' ideas to promote improved collective understanding of a theme or topic.¹¹

The level of substantive conversation was low at both schools (see Table 34). The typical level at each was level one. This level was defined as “virtually no features or substantive conversations occur during the lesson.” The differences between the schools were not statistically significant.

¹¹ Newmann, F. M., Secada, W.G., and Wehlage, G.G. (1995). A Guide to Authentic Instruction and Assessment: Vision, Standards, and Scoring. Madison, WI: Wisconsin Center for Education Research, University of Wisconsin.

Table 34. Ratings on the substantive conversation dimension of authentic instruction, by school.

	Number of SJHS Teachers	Number of OLJHS Teachers
Substantive Conversation (SJHS N=8; OLJHS N=12)		
One	5	10
Two	1	2
Three	1	0
Four	1	0
Five	0	0

Opinions About the Use of Laptops

There were statistically significant differences between SJHS students and OLJHS students regarding how often they would like to use laptops in school and how often they would like to use a computer or laptop for homework (see Table 35). Over three-fourths of the students at SJHS indicated that they would like to use laptops in school more than they do now, in contrast to 31% of OLJHS students. Students at OLJHS were more likely than students at SJHS to say they would like to use laptops in school about the same amount (57%, 21%). The pattern was similar when students were asked about using a computer or laptop for homework. SJHS were significantly more likely to select the option “More than I do now” (78%, 34%) and OLJHS students were more likely to select the option “About the same amount” (52%, 16%).

Table 35. Opinions about the use of computers or laptops at school and at home.

Survey question	Less than I do now	About the same amount	More than I do now
I would like to use laptops in school*:			
SJHS	4%	21%	76%
OLJHS	12%	57%	31%
I would like to use a computer or laptop for homework*:			
SJHS	6%	16%	78%
OLJHS	13%	52%	34%

*Indicates significant difference between schools at the .05 level in responses to this question.

When asked how much it matters to have access to the same software at home as at school, the majority of SJHS student respondents (68%) thought that it would matter a lot to have access to the same software, whereas less than half of OLJHS student respondents thought it mattered a lot (37%), and 40% thought it mattered some (see Table 36). The differences in students’ responses were statistically significant.

Table 36. Importance of having similar software at school and at home.

Survey question	No Difference	Very Little	Some	A Lot
How much of a difference does it make, if any, whether or not you have access at home to the same software that your teachers use in class?*				
SJHS	6%	4%	23%	68%
OLJHS	11%	13%	40%	37%

*Indicates significant difference between schools at the .05 level in responses to this question.

Students were asked to briefly explain their answer and their resulting comments help explain the results. A majority of the students described the challenges involved when they did not have the same software as their teachers used in class. They described how having to use different software changes things around in documents and makes their work more difficult. They also talked about not being able to finish their homework and not being able to do their best work or learn as well when they didn't have the same software as their teachers. Some students mentioned the inequity that occurs when not all students have the same access to the software used in class. Representative student comments are as follows:

Some teachers make worksheets for us to complete on software we don't have, then when we open it, it opens in a different program and changes everything around making it hard.

Not having the same software can change your work. There's a difference between AppleWorks & Microsoft Word Press. It makes it hard to transfer documents when it will be changed to a different format, or your computers won't be able to read it.

Because, if they write something in Word and I don't have Word when I get it from the public folder, I cannot change it and save it and be able to reopen it.

It makes it easier to get assignments they put on the server if you have the ability to pen them and they are compatible with your computer.

It lets me do exactly what my teacher does in class, at home.

You want to be able to use the same things your teachers use because then it is easier all around for a better understanding.

A lot because if you don't have the same software as you use in class you may get more confused.

Being able to have the same software at home as my teachers use in class helps me understand what I am doing better and it helps keep me on track with school.

If I have a teacher who teaches using a program that I do not have, it makes a difference in my learning.

If the software is different at school than at home, you can't spend as much time on the project and your true best isn't always the finished product.

Well I personally have troubles getting assignments turned in because I don't have the same programs and I don't have time to stay after school because my parents work a lot until late so that causes my grades to be lower. It makes me look like I didn't try to complete it and turn it in on time.

If you don't finish a project or something at school then you have to go in early because you don't have access to the program.

Because if you don't have the right software you won't be able to get your homework done.

Like if we have to do some stuff in class for a project, we can't do it at home. Only some kids get to. If they have it. Like a PowerPoint. Not that many kids have them and some kids really can't stay after so if they can't get it done in class then they should be able to do it at home.

In contrast, some students explained why it was less important to have the same software as their teachers used in class. They noted that some software is replaceable by others, some software can be easily downloaded, and teachers give directions on how to use different software than they've used in class. Other students remarked that it depended on how much the software was needed for their homework and some students did not mind if they had to use different software than their teachers used. Some representative comments from students are as follows:

I guess it would make a difference, like, you'd be able to understand the assignment more. But there is some software that is replaceable by others, and that's totally fine, too.

It doesn't make that big of a difference because usually if the software is different our teacher gives us directions on how to use other software.

I have access to most things online that my teachers use, but there are a couple that are very helpful to have on my laptop.

Well, most of my homework has to do with websites and not software. Some homework does require me having the same software, so I would say about the same.

I use Microsoft Word at home, and that and the Internet (i.e. Ask.com for questions) are all I really need.

It doesn't matter. I can do it on my home computer without the same software.

Although the survey question asked about having the same software at school and at home, almost as many students wrote comments about the importance of having Internet access at home

to explain their answer about software. In their comments about Internet access students described its importance for several tasks: doing research required for homework, accessing an online textbook, checking the planner for assignments and grades, blogging for class, and accessing the school server to use a teacher's drop box or transfer files. Students also noted that not all students' families can afford Internet access. Representative comments are shown below.

A lot, because some kids don't have Internet access at home.

If I don't have an Internet connection at home, and my homework is on the server, it is very hard to do that at night, and I have to come in early to get it finished.

I have dial-up Internet and it takes forever to load. If I need to do a computer project out of class, I usually have to stay after school or come in early which is really hard to do with my busy schedule.

Sometimes we have to drop our work during the weekend and if we don't have access, we can't drop it and it's considered late. Also, we do a lot of blogging in [course title omitted by researcher] and some kids don't have the Internet. It's very hard to do our work.

A lot of people I know can't afford internet.

A much smaller group of students described challenges they experienced because their home computer had a different operating system than the computers or laptops at school. Representative comments were as follows:

There are a lot of technicalities that can get complicated when you must transfer schoolwork on an Apple to say schoolwork on a Windows.

I have a Dell PC at home but I can't do much with it because I don't have access to the drop boxes as I do here.

It is difficult to 'turn in' papers that must be linked onto the planner from home with Dell or PC computers.

As would be expected, a significantly greater percentage of OLJHS students had access to a computer or laptop at home than SJHS students (see Table 37), although the proportion of SJHS students that indicated they have access at home was also high at 88%. Further, students at OLJHS were significantly more likely than students at SJHS to report having an adequate amount of time to access the computer or laptop at home to work on their homework (75% versus 57%, respectively). Over 90% of the students at each school said the computer or laptop they use at home is connected to the Internet. Over two-thirds of the students at each school indicated that the computer or laptop they use at home is fast enough for them to do their homework; 70% of the SJHS students selected this response option as did 74% of the OLJHS students.

Table 37. Home access to computer or laptop and Internet.

Survey question	Yes	No
Do you have access to a working computer or laptop at home?*		
SJHS	88%	12%
OLJHS	93%	7%
Is this computer or laptop connected to the Internet?		
SJHS	91%	9%
OLJHS	93%	6%
If yes, do you think the computer or laptop is fast enough for you to work on your homework?		
SJHS	70%	31%
OLJHS	74%	26%
Do you have enough access time on this computer or laptop at home to work on your homework?*		
SJHS	57%	44%
OLJHS	75%	25%

*Indicates significant difference between schools at the .05 level in responses to this question.

When students were asked to indicate what activities they engaged in during their time at home working on school work, the top selected responses were as follows (see Table 38): find information for assignments (96%, 93%), organize information (92%, 94%); and work on assignments (92%, 94%). A greater percentage of SJHS students selected email a teacher (48% vs. 38% of OLJHS students), and a greater percentage of OLJHS students selected email other students (38% vs. 29% of SJHS students).

Table 38. Types of computer or laptop activities at home.

Survey question: <i>"When I use a computer or laptop at home for school projects and assignments, I do the following (check all that apply)"</i> [#]	Percent of SJHS student survey participants	Percent of OLJHS student survey participants
Find information for assignments	96%	93%
Email a teacher(s)	48%	38%
Email other student(s)	29%	38%
Organize information	92%	94%
Work on assignments	92%	94%
Do drills to increase my skills	25%	24%
Other – please explain below	15%	12%

[#]Multiple response item.

A majority of students from both schools reported that using a computer or laptop at school or at home makes schoolwork more enjoyable (see Table 39). There was a significant difference between the schools, however. SJHS students were significantly more likely than OLJHS students to report that using a computer or laptop makes schoolwork more enjoyable (83%, 69%) and OLJHS students were more likely than SJHS students to choose the response option "about as enjoyable" (23%, 13%).

Table 39. Enjoyment of schoolwork.

<u>Survey question</u>	Less enjoyable	About as enjoyable	More enjoyable
Using a computer or laptop, at school or at home, makes schoolwork : *			
SJHS	4%	13%	83%
OLJHS	8%	23%	69%

*Indicates significant difference between schools at the .05 level in responses to this question.

The survey results show that there was a significant difference between schools in students' writing behavior at school (see Table 40). While 87% of OLJHS students used a computer or laptop for both drafts and final copies at school, 73% of SJHS students reported this behavior. SJHS students selected "final copy only" more often than OLJHS students (20% and 7%, respectively). Students at both schools reported similar use of laptops and computers for writing at home.

Table 40. How students use laptops/computers for writing.

<u>Survey question</u>	Drafts and final copy	Final copy only	Drafts only	Not at all
How do you use a computer or laptop for writing at school?*				
SJHS	73%	20%	3%	4%
OLJHS	87%	7%	3%	3%
How do you use a computer or laptop for writing at home?				
SJHS	74%	18%	1%	7%
OLJHS	77%	12%	4%	7%

*Indicates significant difference between schools at the .05 level in responses to this question.

Table 41 shows students' responses to a variety of survey items addressing their opinions about computer or laptop use and how it affects their learning. There were statistically significant differences in students' responses between the schools on the following items:

- Now that I have access to a computer or laptop I go to the school library less often to locate information.
- I am more likely to revise/edit my work when it is done on a computer or laptop.
- When I have access to a computer or laptop I am better able to understand my schoolwork.
- Since I received access to a computer or laptop the quality of my work has improved.
- I would rather not use a computer or laptop.
- All the information on the Internet makes it difficult for me to research/analyze information.
- I prefer to handwrite assignments rather than use a computer or laptop.

The only item for which there was not a statistically significant difference between the responses of SJHS students and OLJHS students was the item “Having access to a computer or laptop helps me to be better organized.”

With the exception of the item about how often students go to the school library to locate information, SJHS students were significantly more likely to indicate some level of agreement with an item (or disagreement for the reverse-worded items) on all of the items listed in Table 41. It is not surprising that OLJHS students would be more likely to indicate that they used the library less often because their laptops provide online access to the wide array of resources on the web.

For each of the items for which there was a statistically significant difference between the responses of SJHS students and OLJHS students, the significance was related to differences in the degree of agreement (somewhat agree, agree, strongly agree), or disagreement for the reverse-worded items (somewhat disagree, disagree, strongly disagree), reported by students rather than differences between agreement and disagreement. For example, for both schools, the majority of students somewhat agreed, agreed, or strongly agreed with the statement “I am more likely to revise/edit my work when it is done on a computer or laptop” respectively (SJHS 93%, OLJHS 92%). Only 7% of the SJHS students and 8% of the OLJHS expressed any level of disagreement with this item. In other words, the majority of students at each school indicated positive opinions and effects related to computer or laptop use, but students at SJHS were more likely than OLJHS students to report stronger levels of agreement (or disagreement for reverse-worded items).

Table 41. Students' opinions about computer or laptop use and how it affects their learning.

Survey question: <i>"Indicate how much you agree or disagree with each of the following statements about YOUR COMPUTER or LAPTOP USE:"</i>	Disagree	Agree
Now that I have access to a computer or laptop I go to the school library less often to locate information.*		
SJHS	26%	74%
OLJHS	12%	88%
Having access to a computer or laptop helps me to be better organized.		
SJHS	10%	90%
OLJHS	10%	90%
I am more likely to revise/edit my work when it is done on a computer or laptop.*		
SJHS	7%	93%
OLJHS	8%	92%
When I have access to a computer or laptop I am better able to understand my schoolwork.*		
SJHS	14%	86%
OLJHS	18%	82%
Since I received access to a computer or laptop the quality of my work has improved.*		
SJHS	10%	90%
OLJHS	16%	84%
I would rather not use a computer or laptop.*		
SJHS	89%	11%
OLJHS	79%	21%
All of the information available on the Internet makes it difficult for me to research/analyze information.*		
SJHS	82%	18%
OLJHS	81%	19%
I prefer to handwrite assignments rather than use a computer or laptop.*		
SJHS	83%	17%
OLJHS	76%	24%

*Indicates significant difference between schools at the .05 level in responses to this question.

The survey also included items about who students turned to when they need help with a computer or laptop and how likely that person was able to help them. There were no significant differences between the schools in this area. Students at either school are most likely to ask a friend or another student for help (see Table 42). Thirty-six percent of the SJHS students said they would usually ask a friend or another student and 33% of them said this person was usually able to help them. The proportion was slightly higher at OLJHS: 41% of the students said they would usually ask a friend or another student and 38% of them said this person was usually able to help them. Students at each school also turn to teachers when they need help with a computer or laptop and most say the teacher is usually able to help them.

Table 42. Resources for helping students with computers or laptops.

Survey question: <i>“For each of the following people, select the answer that best describes both how often you ask for help from them AND if they are usually able to help you when you need help with a computer or laptop in school”.</i>	Not very often – usually able to help	Not very often – usually not able to help	Sometimes – usually not able to help	Sometimes – usually not able to help	This is the person I usually ask – usually able to help	This is the person I usually ask – usually not able to help
A teacher:						
SJHS	18%	4%	45%	5%	28%	<1%
OLJHS	20%	6%	47%	3%	23%	1%
A friend or other student:						
SJHS	19%	10%	29%	6%	33%	3%
OLJHS	15%	5%	35%	5%	38%	3%
Media Specialist:						
SJHS	59%	13%	16%	2%	9%	1%
OLJHS	54%	17%	13%	2%	12%	2%
Technology support person or technology coordinator:						
SJHS	56%	11%	19%	2%	10%	1%
OLJHS	48%	8%	21%	1%	20%	3%
Other adults in the school:						
SJHS	49%	28%	13%	4%	5%	1%
OLJHS	46%	30%	17%	3%	4%	1%

A related survey question asked students how often they or another student are able to fix a problem when it occurs. Students' responses were significantly different between the schools (see Table 43). Almost half (48%) of the SJHS students selected the response "frequently" in contrast to 32% of the OLJHS students. OLJHS students were more likely to report that they or a friend were able to fix computer problems sometimes.

Table 43. Students' ability to fix computer problems.

Survey question	Not very often	Sometimes	Frequently
How often are you or another student able to fix a computer problem?*			
SJHS	11%	42%	48%
OLJHS	18%	50%	32%

*Indicates significant difference between schools at the .05 level in responses to this question.

On-Task Classroom Behavior and Student Engagement

There were two sources of information on how access to a computer or laptop might affect student engagement levels: classroom observations conducted by the researchers and students' responses on the survey. First, as part of their classroom observations the researchers counted the proportion of students physically engaged in the lesson at 15 minutes and 30 minutes after the start of the period. As shown in Table 44, the results were similar between the schools. At 15 minutes into the class period the median¹² proportion of students who were physically engaged was 100% in each school. The average proportion for SJHS is slightly higher at 95% than the average proportion for OLJHS at 86%, but the difference was not statistically significant. In situations such as this, where the number of data points is small, the median is often a better summary indicator of the central tendency of the data than the average, which is influenced by extremely high or extremely low values. At 30 minutes into the class period, student engagement levels remained high at both schools.

Table 44. Proportion of students in each classroom who were physically engaged in the lesson, by school.

	SJHS (N=11)	OLJHS (N=12)
15 Minutes into Class Period		
Median	100%	100%
Average	95%	86%
Range	70-100%	33-100%
30 Minutes into Class Period		
Median	100%	97%
Average	94%	89%
Range	75-100%	47-100%

¹² The median is the middle proportion in a distribution of all the teachers' proportions: half the proportions are above the median and half are below the median.

Second, based on students' self-report on the survey, SJHS students were significantly more likely than OLJHS students to be positively affected by computer or laptop use (see Table 45). Eighty-six percent of SJHS students agreed when asked if they were more involved in school when they have access to a computer or laptop; this contrasts with 80% of the OLJHS students who chose some level of agreement as their response. SJHS students were also significantly more likely to indicate they agreed when asked if they do more work when they have access to a computer or laptop (86%, 80%) and if they are more interested in school when they use the computers or laptops (91%, 81%).

Table 45. How computer or laptop use affects students' involvement and interest in school.

Survey question: "Indicate how much you agree or disagree with each of the following statements about YOUR COMPUTER or LAPTOP USE."	Disagree	Agree
I am more involved in school when I have access to a computer or laptop.*		
SJHS	14%	86%
OLJHS	20%	80%
When I have access to a computer or laptop I do more work.*		
SJHS	14%	86%
OLJHS	20%	80%
When we use the computers or laptops I am more interested in school.*		
SJHS	9%	91%
OLJHS	19%	81%

*Indicates significant difference between schools at the .05 level in responses to this question.

Another indicator of students' engagement in learning is how often students use a laptop to go beyond what their teachers have assigned. As shown in Table 46, OLJHS more often reported that they use the laptop to learn about things not assigned in class (60%, 55%). The difference was not significantly significant, however.

Table 46. Laptop use for learning beyond class assignments.

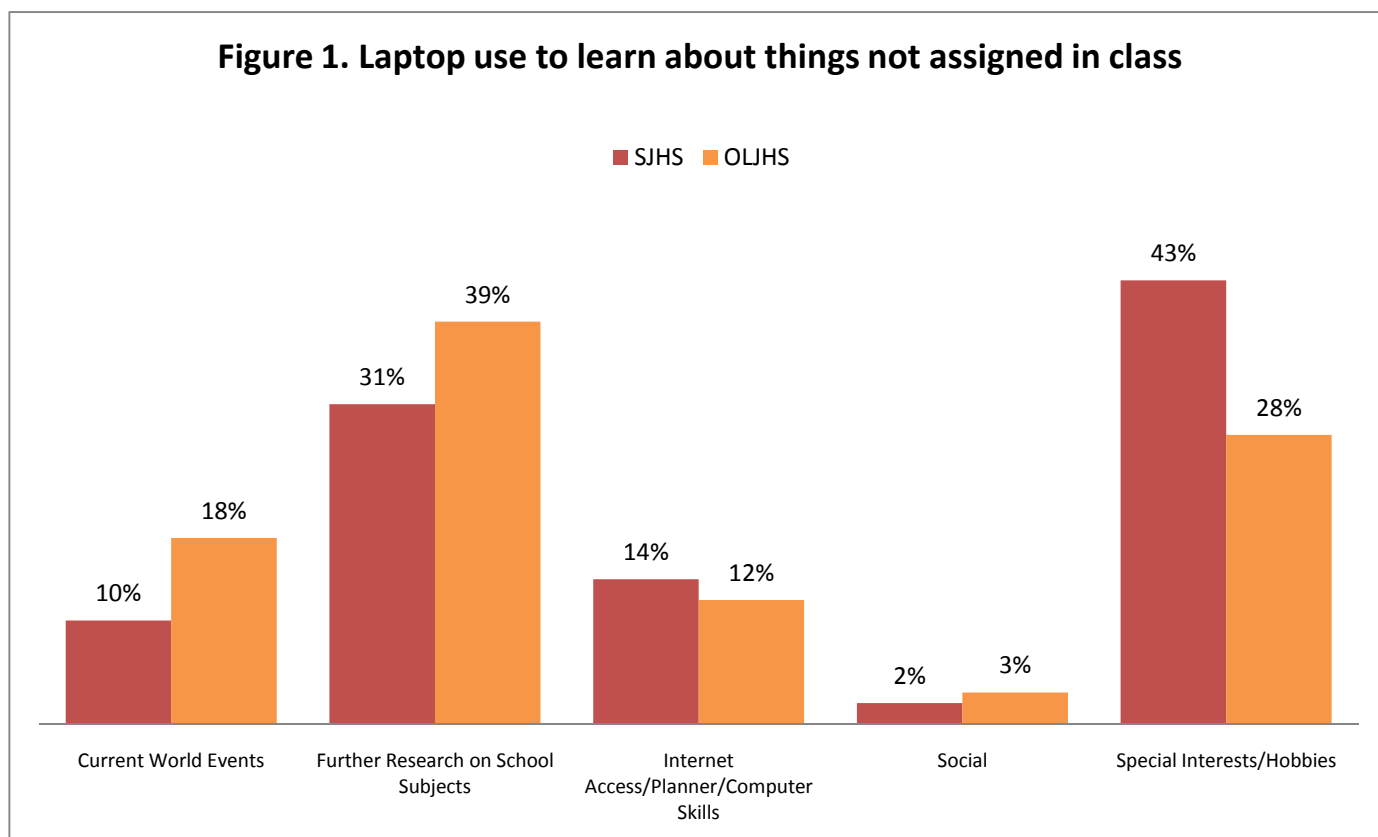
Survey question	Yes	No
Do you use the laptop to learn about things not assigned in class?		
SJHS	55%	45%
OLJHS	60%	40%

When asked to describe the types of things they use laptops for to learn beyond their class assignment, students offered comments on a wide variety of topics. Fifty-five percent of the OLJHS students and 50% of the SJHS students responded to this open-ended question. The majority of the students at both schools described how they used their laptops to pursue their

curiosity once their interests were piqued about a topic. After reading through the comments, the following categories emerged from the data:

- Current World Events (News, Weather, Stock Market, Politics, Community)
- Further Research on School Subjects
- Internet Access/Planner/Administrative/Organization/Help Parents/Computer Skills
- Social (MySpace, Instant Messenger, Email, Facebook)
- Special Interests/Hobbies/Music/Games/Entertainment

Figure1 shows the percentage of comments in each category from each school.



Further Research on School Subjects

The largest category of student comments from OLJHS was Further Research on School Subjects with 39% of the OLJHS comments. The OLJHS students mentioned many subject areas, some broad areas and some particular topics or specific websites that might be covered in class or that they have learned about. The comments about further research were overwhelmingly positive, and students used words that capture their feeling of excitement, curiosity, interest, or empowerment; phrases such as “*neat to learn*” or “*I like to learn about...*”, or “*it helps us learn about...*”, or “*it got me interested*” suggest that they are aware that their use of the laptop for learning is complementary to what is happening in class. Many of the comments in this category could overlap with the Special Interests category, since areas of study become topics of interest

for students. All of the comments have been cited verbatim from students' own writing. Some example comments:

because if you need to know about something they are talking about in class and you don't know what it is you can look it up

I like to learn more about the topics that we talk about in class. I go to wikipedia and read articles about stuff we learn in class.

things like science and geography and some times math.

I like to learn about extra information that the teacher does not need to teach the students, or other ways to solve problems such as in math class.

it helps us learn about the culture and how our environment works and other science stuff, and english, and everything that we talk about in school the teachers always tell us stuff that is neat to learn.

you might click on a link in an assignment and find more out about it

About interesting things related to a subject we are learning about in school, like if we were learning about George Washington in school and I thought that the subject of presidents was intriguing, then I would start to research presidents.

I usually go look up the history about Roman and Greek Mythology. But only for my free time.

Something that got me interested in class. For instance, in German, we studied famous German people and the person I studied was a scientist. It got me interested in some factors of science, and I used my laptop to look up things about that.

Thirty-one percent of SJHS students' comments were about Further Research on School Subjects. SJHS students' comments were similar to OLJHS's in terms of the types of topics the laptops are used to study; however, their comments reflect a more limited range of acceptable activities for using the laptop for learning at school since they are not taking the laptops home to

use without teacher supervision. Many students allude to how “appropriate” their use of the laptops is during their access to them, or how further research can be accomplished using books as well. This is a contrast from the OLJHS comments:

It doesn't just go for laptops, but for books or any other kind of source as well. Whenever I'm suppose to research anything, I learn a lot more about that topic than is needed in the paper.

When we have extra time with the laptops I enjoy researching possible college options.

In science, i use it to look up science questions that i have been wondering about. i never use them for recreational perposes unless the teacher tells us otherwise.

I love nature so sometimes I will google a new species of bird and learn about it some more. Plus if I am reviewing for a test or quiz then the computer is a great resource

well if you finish what your suppose to do in that class you can always work on somtihng from a differnet class.

things that might not have everything you need in the textbook

I learn more above and beyond what the subject is teaching us. It helps me become a smarter person.

like if i dont get somehting the teacher says ill loke it up so i will get it easer but if i dont have the same tools no my familys computer then it would be kind of hard.

Current World Events

Many OLJHS students also commented on their use of laptops for finding out more about current world events, with 18% of comments in that category. Topics such as news and weather were mentioned repeatedly, and many students mentioned CNN.com specifically. Students report that they pull out their laptops to further research world or community events that are mentioned in the news and/or at school:

About issues on the news, issues that come up at school (global warming, etc).

Just out side stuff with the oil and gas prices and stuff like that.

I sometimes go on cnn.com and read about things going on in the world. Or I learn about new kinds technology

If I'm watching the news or some other show and I see or watch something that has an interesting subject or fact that I find interesting, sometimes, I will go to my laptop and research it on the internet out of curiosity.

Upcoming DNR events.

I look and see what happening at the Highschool and about sports that are going on.

I always check on what is happening in the presidential race and the NHL.

Usually just what's going on around the world. Obviously I'm not on myspace. It's usually Yahoo stuff and sports like the NHL and other stuff. I also keep track of the stock market.

Politics, weather, other cool things going on in this world.

I learn about things that I just happen to read on the news or someplace else that it could pop up. I learn about the war and hunger and this is all on the news online. I LOVE IT!!!!

Ten percent of SJHS students' comments were related to Current World Events. The content of their comments in this area were similar to the comments of OLJHS students in this area. For example, students wrote the following:

world news

its not related to school. its more about reality.

I use it to check emails, check on the weather, news etc.

I learn about orangutan concservation and about what the Como Zoo is doing to help orangutans.

I have to be honest - I do look at other websites mainly involving politics.

I use it to learn about world events and news.

Special Interests and Hobbies

Students reported a wide variety of uses for the laptops to pursue their hobbies and interests. Twenty-eight percent of OLJHS students' comments were about how they use the laptops for fun hobbies:

Mixed Martial Arts, Music, all sorts of things. Odd things like large underground bodies of water in China.

playing games, listening to music

anything

home interests

Well, about actersses, or actors, things that look interesting, and ect...

i learned about things like cameras and other things

Shakespeare, Jack the Ripper, The Zodiac, Mythology

I sometimes Google random things and learn about them.

I also look up recipes.

Physics, positrons, Zeno's paradoxes, probability of winning powerball, deuterium, tritium, etc.

Different kinds of animals and how the rain cycle works, how lasers work and other things like that

Forty-three percent of SJHS students' comments were about Special Interests and Hobbies and the highest proportion of SJHS students' comments fell in this category. The responses covered a wide variety of topics, some related to topics studied in school. Again, comments are made in the context of having extra time after an assigned activity is completed:

What kind of bass Paul McCartney plays. (Hv?fner 500/1 Vintage '62 Violin Bass)

games,shopping

information about horses and my job and stuff.

Sciences and music

Every kind of thing! Whatever I should happen to see.

If I get done early I sometimes look things up on Google or play games.

just about celebs and stuff like whats the style

Any random fact that may catch my mind.

Also, I notice peers tend to look at iTUNES and other online games that are totally irrelevant to the lesson assigned in class.

*I like researching things that I am curious about, not just things in school.
like how to build decks. rooftops. and mexican belts*

Internet Access/Planner/Computer Skills

OLJHS students in particular took this question as an opportunity to comment on how access to the Internet and computer use has helped them to gain computer skills which they use to help their parents with research, to organize their school work, or to give them future job skills. For the Internet Access/Planner/Administrative/Organization/Help Parents/Computer Skills category, 12% of OLJHS's comments included observations about how quickly they can find the information they are looking for by getting on the Internet, how they explore how computers work, how they use the planner to keep track of their progress, and how they are now familiar with how to use software.

homework if i missed a class, what we are working on tomorrow, and next week so that i can get ahead.

The world is becoming full of technology. With these laptops we are learning so much about them and how to use them. It's not only the laptops though, there's the internet, bluetooth, and other different applications.

I learn how technology can benefit me, and that I am lucky enough to have the opportunity to use it at such a young age. Plus this will help me later in life

I learn how to use computers more. I learn about things I'm wondering, like maybe how to spell a word or what it means, and I can look it up right away. Also I use it to learn fun facts or just if I'm curious about a certain subject, I can look it up

I've learned more about Mac Software & Applications, and I also used it for advanced & expert video production techniques (not the ones assigned in video production).

I use it to discover what possibilities there are on these kinds of computer. I never knew what google sketchup could do. I never knew about iMovie. I never even knew about anything involving these computers till I got into 7th grade. I learned even more in

Fourteen percent of SJHS students' comments fell in this category. Again, the comments were similar to OLJHS's in content as far as how laptops can be used to increase computer skills or to use the planner, but there was also more reference to rules, lack of time, or differences between home and school Internet access or speed:

how to run different applications. how to connect to server. how to use the applications. how to download different things. how to use different stuff on the computer and more

I can look up things that i can't at home. It's actually a good thing cause if i have spare time i can look up those things.

I am pretty good about all the things teachers teach about computers/laptops at school so I can explore a lot more and so I learn more things about that specific program.

How to bypass the school's filtering system. And hack the mainframe in order to use C++ to change the directory info. Pretty fun actually.

I like to research about the subject we are assigned and looking at pictures. I try to use the internet at school because it is ten times faster than at home.

I look for study guides, I also play study games.

Sometimes I don't get what homework was assigned, so I can go online and see what I have to get done.

Social

Three percent of OLJHS students' comments and 2% of SJHS students' comments fell into the Social category. For example, students wrote

I like myspace. i like aim.

School email with friends and I just write stuff on the computer, or use magic pen.

I have seen other kids "learning" other things. Such as learning how to play games, Email, go on MySpace, etc. Though these things are prohibited, people do them anyways.

Student Achievement

The analysis of the achievement data occurred in two parts. The first part included the available data from all students enrolled at SJHS or OLJHS. The second part included the available data for the following subsets of students only: a) students whose scores on the MAP reading test in the fall of their 7th grade year were in the lowest quartile for that test, and b) students whose scores on the MAP mathematics test in the fall of their 7th grade year were in the lowest quartile for that test.

Analysis of Data from All Students. First, descriptive statistics were calculated for the students' MAP achievement test scores and percentiles at each school at each time point for each cohort. As described earlier, Cohort I began 7th grade in fall 2004, Cohort II began 7th grade in fall 2005, and Cohort III began 7th grade in fall 2006. The number of students included in the analysis for each test within each cohort is as follows: Cohort I: N=618 for reading, N=591 for mathematics; Cohort II: N=468 for reading, N=455 for mathematics; Cohort III: N=668 for reading, N=480 for mathematics. The range of scores for all students across cohorts in the data set was 154-262 for reading and 155-298 for math. Tables 1-3 in the appendix display the descriptive statistics — minimum, maximum, mean, and standard deviation — for the math scores and percentiles, and the reading scores and percentiles for each school at each time point for each cohort.

Then, for each cohort, statistical tests were used to compare the rate of growth on the reading and mathematics test between students enrolled at SJHS and students enrolled at OLJHS. A split-plot

analysis was conducted to determine whether there were significant main effects for school or time (indicated by semester) and whether the interaction between the two factors was statistically significant. The following charts of the marginal means at each time point for each school illustrate the mean math or reading score for each school at each time point. Figures 2-4 show how close the schools were in achievement over time. With the exception of growth in reading for students in Cohort III, the differences were not statistically significant. For Cohort III, students at SJHS had a significantly higher growth rate in reading from the fall of 7th grade in 2006 to the fall of 8th grade in fall 2007 (See Figure 4). The estimated average score on the reading test for SJHS students was 219.8 in fall 2006 and 224.4 in fall 2007. In contrast, the estimated average score on the reading test for OLJHS students was 222.1 in fall 2006 and 225.1 in fall 2007.

Analysis of Data from Students in the Lowest Quartile on the MAP Tests. The second part of the analysis focused on students who had scored in the lowest quartile, defined for the purposes of this evaluation as less than 26%, on either the MAP reading test or the MAP mathematics test in the fall of 7th grade. Descriptive statistics were calculated for the students' MAP achievement test scores and percentiles at each school at each time point for each cohort. Tables in the appendices display the descriptive statistics — minimum, maximum, mean, and standard deviation — for the math scores and percentiles, and the reading scores and percentiles for each school at each time point for each cohort (see Tables 4-9 in the Appendix). No inferential statistics were calculated due to the small number of students in each cohort. Based on a visual examination of the descriptive statistics for students in the lowest quartile, there did not appear to be any notable differences in the growth of reading achievement or mathematics achievement between SJHS and OLJHS.

Figure 2. Estimated marginal means for mathematics by semester: Cohort I

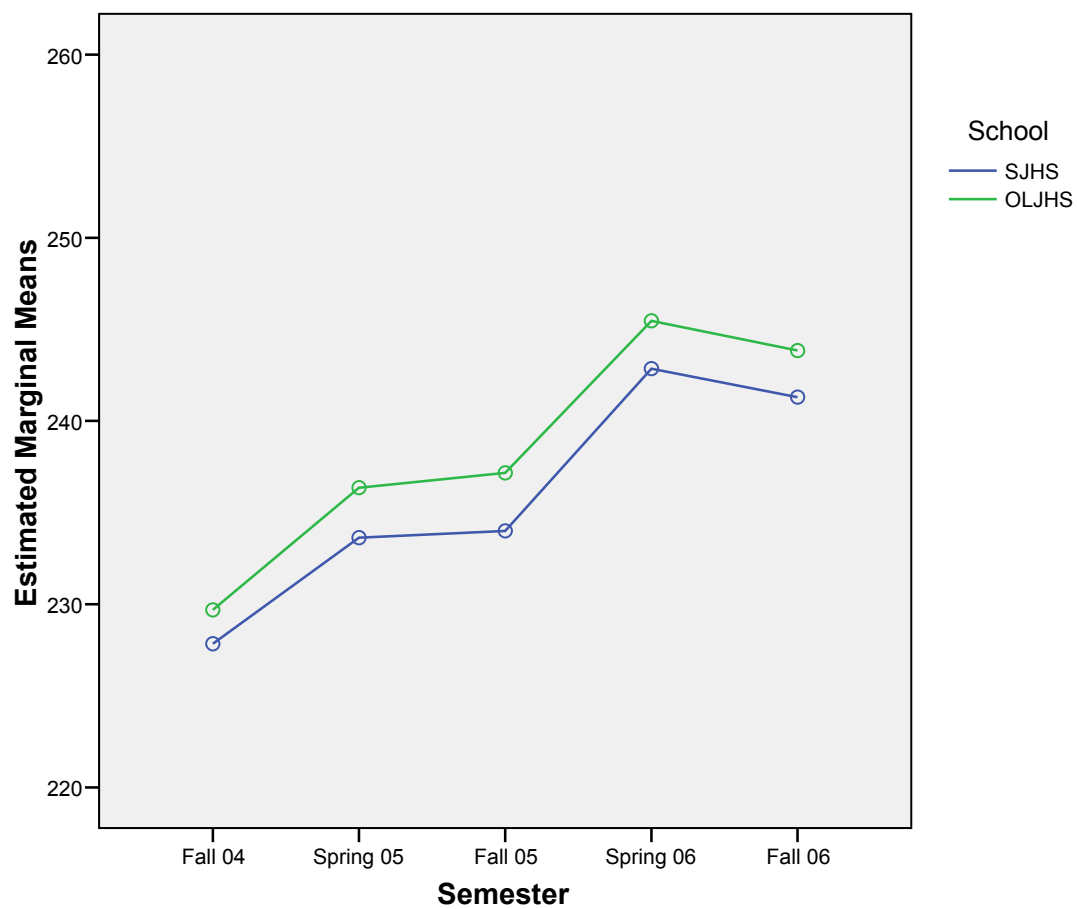


Figure 3: Estimated marginal means for reading by semester: Cohort I

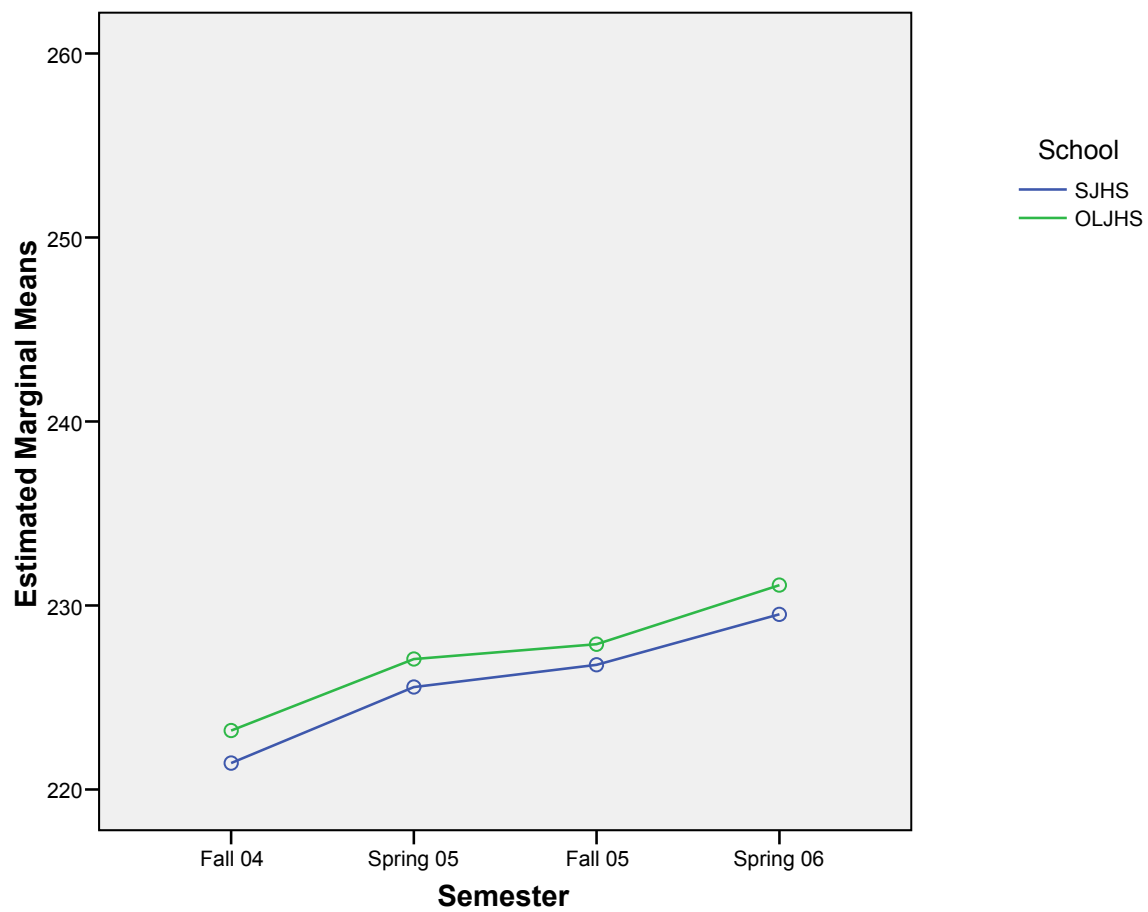


Figure 4: Estimated marginal means for mathematics by semester: Cohort II

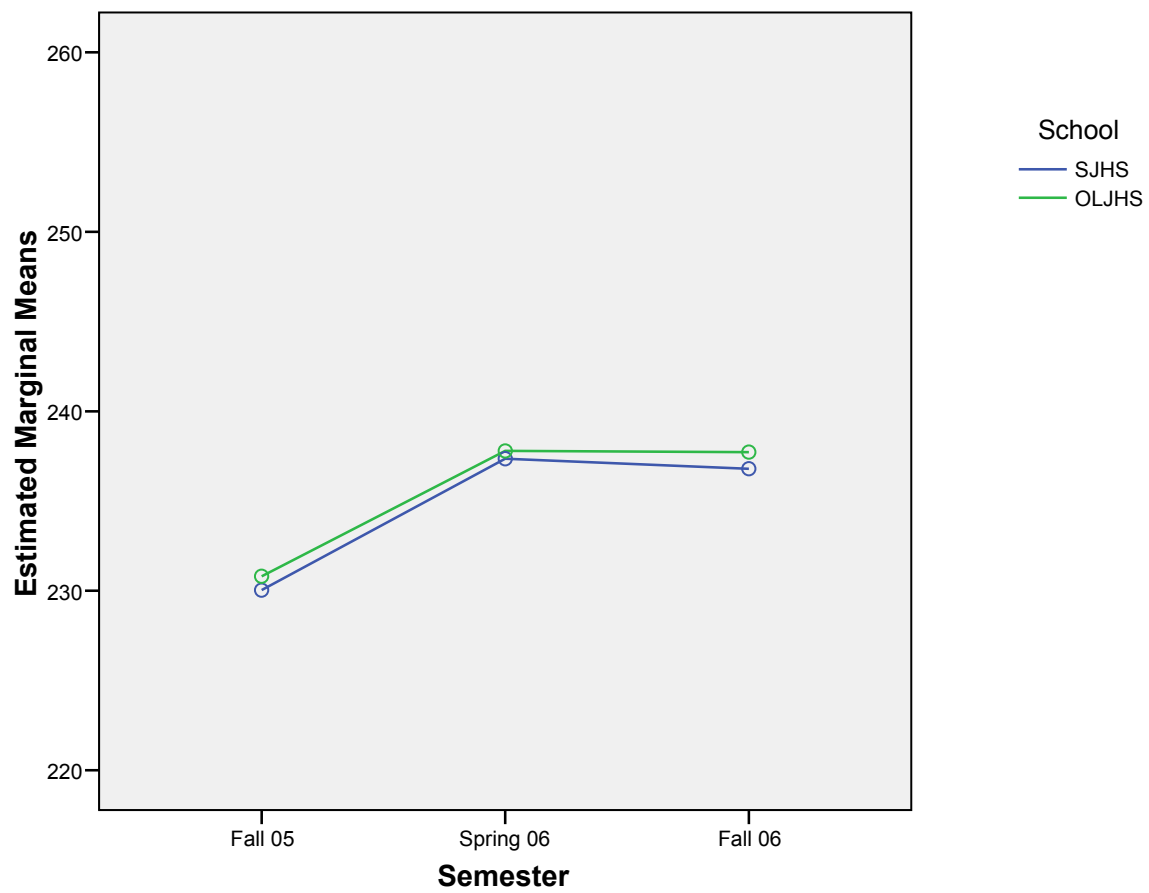


Figure 5: Estimated marginal means for reading by semester: Cohort II

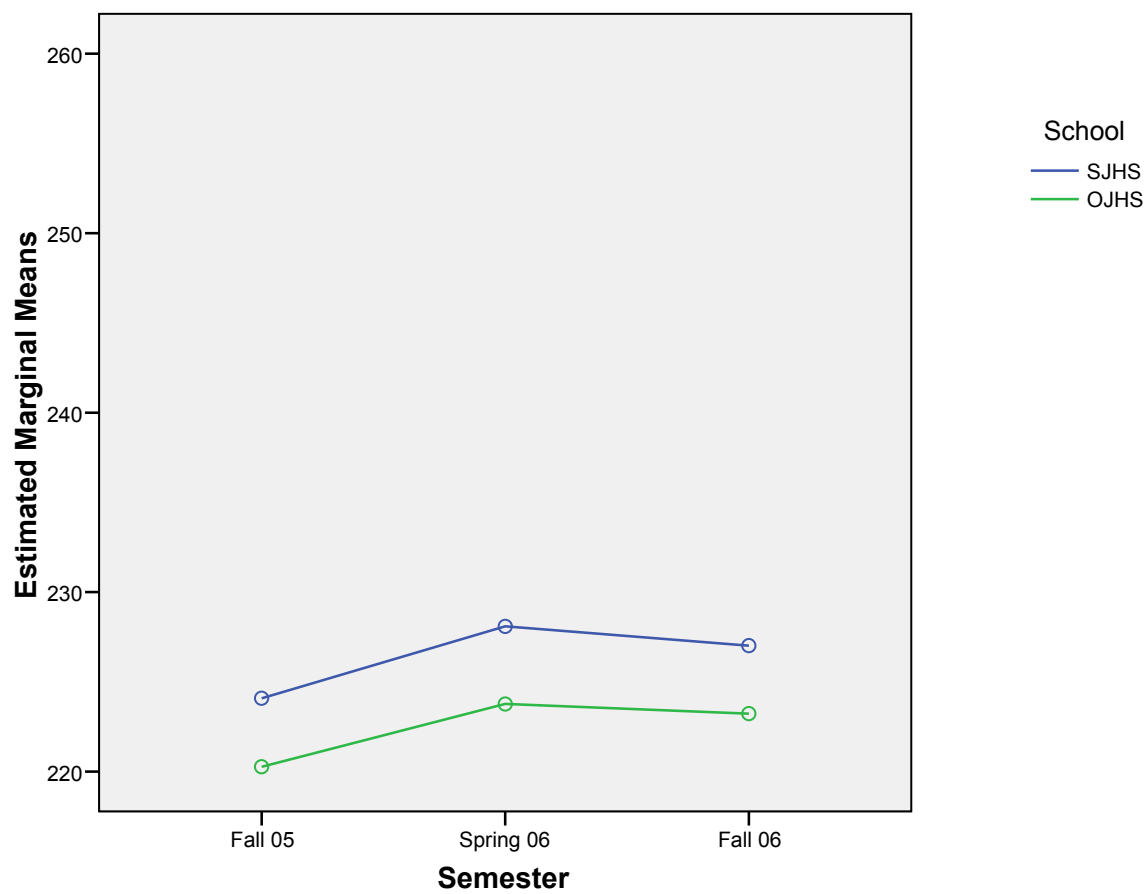


Figure 6: Estimated marginal means for mathematics by semester: Cohort III

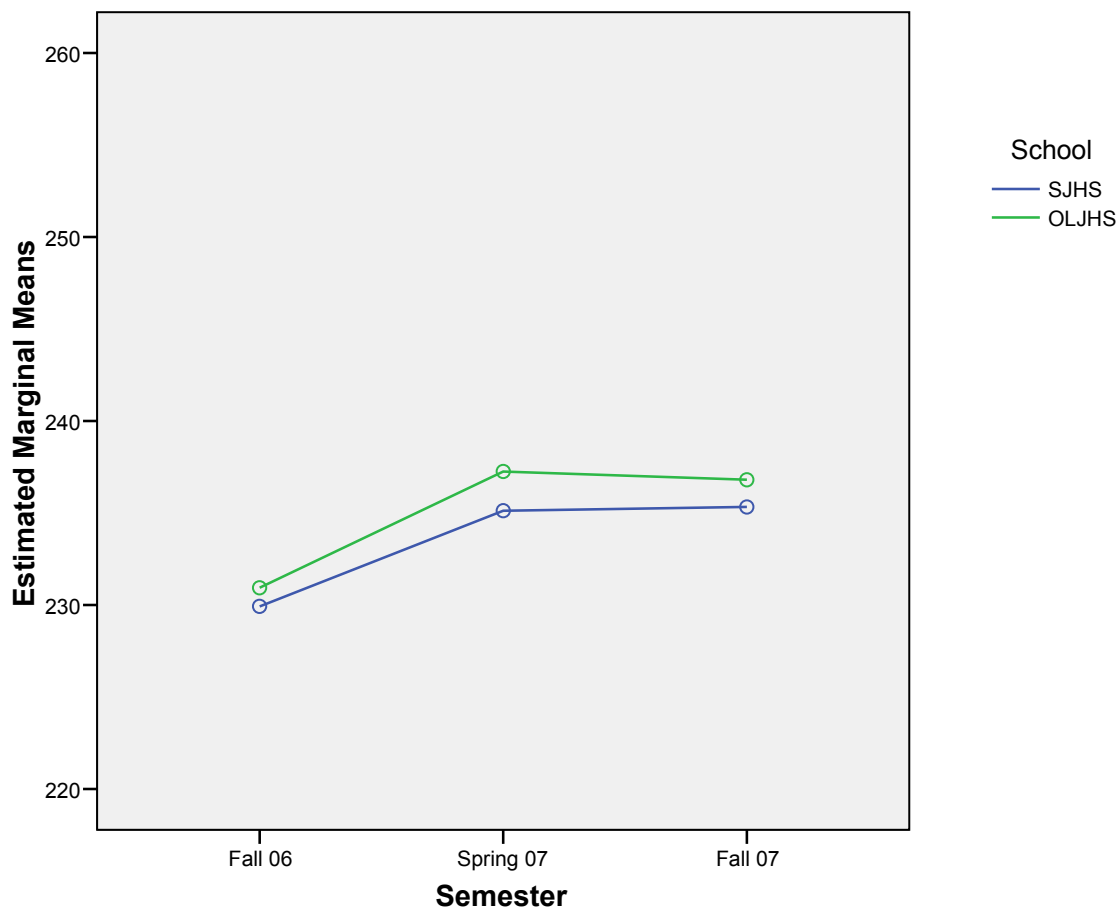
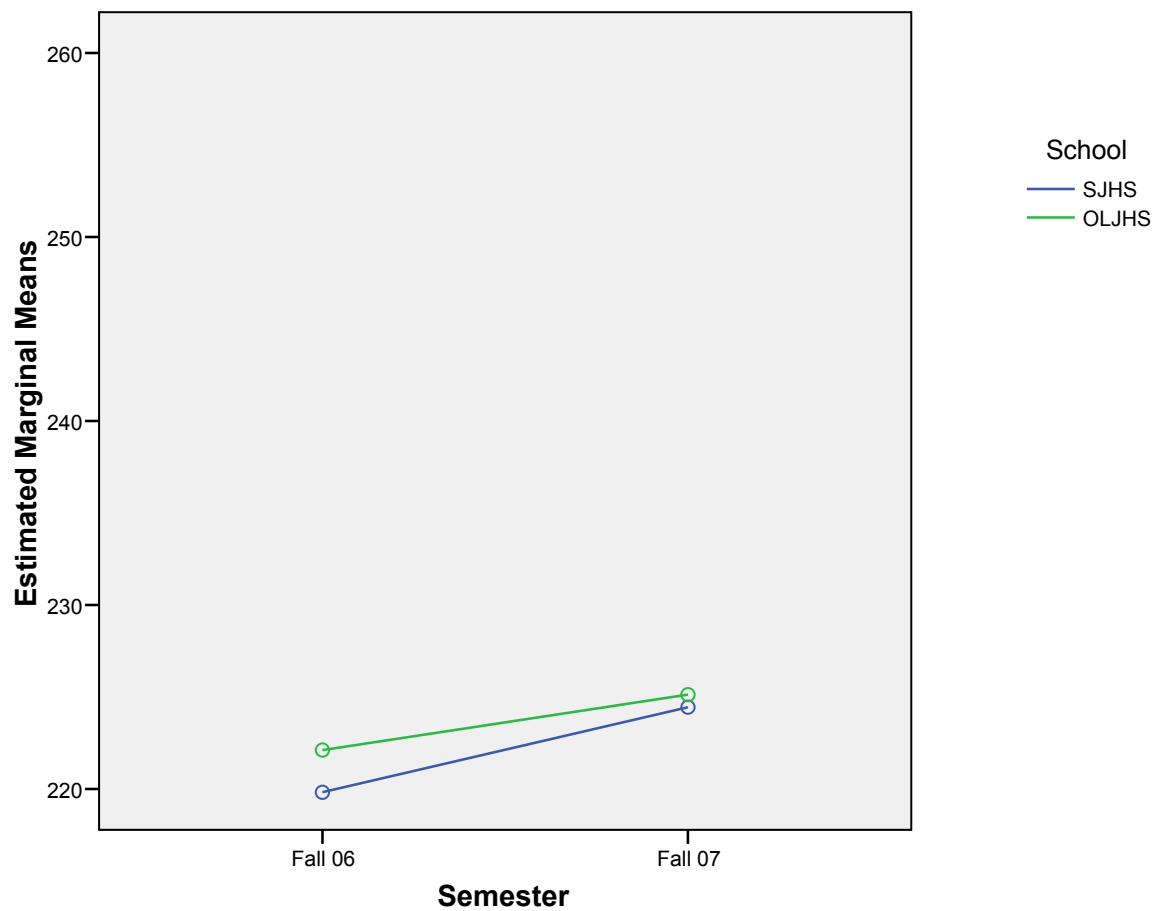


Figure 7: Estimated marginal means for reading by semester: Cohort III



Parents

This section describes findings from the parent survey that covered the following topics:

- How parents assist their children with technology-based schoolwork;
- Frequency and desirability of accessing students' homework assignments and grades; and
- Changes in parent-child conversations as a result of greater access to technology.

How Parents Assist their Children with Technology-Based Schoolwork

Over-three fourths of the parents at each school reported that they've worked on schoolwork with their child using a computer (see Table 47). This suggests that parents are not discouraged from helping their child with schoolwork, even though it may require knowledge of computers and software. Table 48 shows the school subjects parents have worked on with their child using a computer. English language arts was mentioned most often by SJHS parents (66%) and science was mentioned most often by OLJHS parents (58%). Other frequently mentioned subjects among parents at either school were mathematics, social studies, and world languages.

Table 47. Parents' involvement with students' computer use, by school.

Survey question: <i>"Have you worked on school work with your child using a computer?"</i>	Yes	No	Not Sure
SJHS	82%	15%	3%
OLJHS	76%	20%	4%

Table 48. Subjects associated with computer use identified by parents.

Survey question: <i>"If yes, in which subjects have you worked on school work with your child using a computer? (check all that apply)"</i> [#]	SJHS	OLJHS
Art	6%	9%
Business	1%	5%
Computers/Technology	10%	15%
English Language Arts	66%	51%
Family and Consumer Science	7%	14%
Health or Physical Education	28%	21%
Industrial Arts	5%	10%
Mathematics	35%	37%
Music	8%	16%
Science	56%	58%
Social Studies	58%	44%
Special Education	2%	3%
Vocational Education	1%	2%
World Languages	33%	30%

[#]Multiple response item.

Table 49 shows the types of activities parents have done when they have worked on schoolwork with their child using a computer. Helping their child research information on the computer was mentioned most often by both SJHS parents (68%) and OLJHS parents (56%). Other common activities among parents at either school were writing first drafts of papers (55%, 43%), editing papers (57%, 52%), creating culminating projects (34%, 27%), and working on short term assignments/worksheets (38%, 35%).

Table 49. Activities associated with computer use identified by parents.

Survey question: <i>“If yes, which types of activities have you done when you worked on school work with your child using a computer? (check all that apply)”</i> [#]	SJHS	OLJHS
Writing first drafts of papers	55%	43%
Editing papers	57%	52%
Working with spreadsheets or databases	17%	19%
Managing/analyzing information	10%	17%
Researching information	68%	56%
Taking quizzes	24%	17%
Doing drills to increase competency	29%	21%
Creating culminating projects (e.g., web pages/multimedia/formal presentations, etc.)	34%	27%
Working on short term assignments/worksheets	38%	35%
Other	6%	6%

[#]Multiple response item.

Frequency and Desirability of Accessing Students’ Homework Assignments and Grades

One component of the laptop initiative was providing parents and students with the means to access students’ homework assignments/class calendar and grades online. At least three-quarters of the parents surveyed indicated that they used this service (see Table 50). Parents of SJHS students were significantly more likely to use these options than parents of OLJHS students, however. Only 11% of the SJHS parents said they rarely or never checked their child’s assignments/class calendar online in contrast to 25% of the OLJHS parents. Similarly, only 7% of the SJHS parents indicated that they rarely or never checked their child’s grades online in comparison to 17% of the OLJHS parents. Of the parents who do use these online resources, SJHS parents reported significantly higher frequencies of use than the OLJHS parents. For example, 51% of SJHS parents reported that they checked their child’s assignments/class calendar online once or more per month; this contrasts with 34% of the OLJHS parents who said they checked the assignments/class calendar online once or more per month.

Table 50. Frequency of parents' use of online assignments and grades, by school.

<u>Survey question</u>	Rarely or never	Once or more per quarter	Once or more per month	Once or more per week	Once or more per day
How often do you check your child's assignments/class calendar online?*					
SJHS	11%	5%	15%	51%	18%
OLJHS	25%	7%	13%	34%	21%
How often do you check your child's grades online?*					
SJHS	7%	4%	16%	52%	21%
OLJHS	17%	8%	16%	35%	24%

*Indicates significant difference between schools at the .05 level in responses to this question.

Consistent with their higher reported use of the online information, SJHS parents were also significantly more likely to say that access to their child's assignments/calendar and grades online was very important (see Table 51). Eighty-five percent of the SJHS parents marked the very important response choice versus 58% of the OLJHS parents. Further exploration is recommended to identify possible reasons for these significant differences between schools. It seems unlikely that differences in students' laptop access between the one-to-one model and the cart model would affect parents' use of online information about assignments and grades.

Table 51. Importance of access to parents, by school.

Survey question: "How important is it for you to have online access to your child's assignments/class calendar or grades?*	Very important	Important	Somewhat important	Not important
SJHS	85%	10%	1%	4%
OLJHS	58%	13%	11%	17%

*Indicates significant difference between schools at the .05 level in responses to this question.

Changes in Parent-Child Conversations as a Result of Greater Access to Technology

One rationale for putting students' assignments and grades online is that better access to this information will increase the frequency of parent-child communication about school. Parents' survey responses indicate this was true for both junior high schools (see Table 52). Sixty-one percent of the SJHS parents and 46% of the OLJHS parents said they spend more time talking with their child about school work now in comparison to previous years when parents could not check students' assignments/class calendar online. When asked how the availability of online grades affected their communication with their child, 66% of the SJHS parents and 53% of the OLJHS parents indicated that they now spend more time than before talking with their child about grades. In both cases, the proportion of SJHS parents who said they now talked with their student more than before was significantly higher than the proportion of OLJHS parents.

Parents in both schools were less likely to report that they spend more time working with their child on schoolwork in comparison to previous years when their child had less access to computers and laptops at school (see Table 52). Less than one-fourth of the parents at either school indicated that they spend more time doing schoolwork with their child in comparison to

previous years when the child had less access to technology. Typically, parents reported that they spend about the same amount of time doing schoolwork with their child; 52% of the SJHS parents selected this option, as did 43% of the OLJHS parents. There were statistically significant differences in how SJHS parents and OLJHS parents responded to this item. OLJHS parents were more likely to say they spend less time than before working with their child on schoolwork and OLJHS parents were more likely to say they spend about the same amount of time working on schoolwork.

Table 52. Comparison of current access to years past, by school.

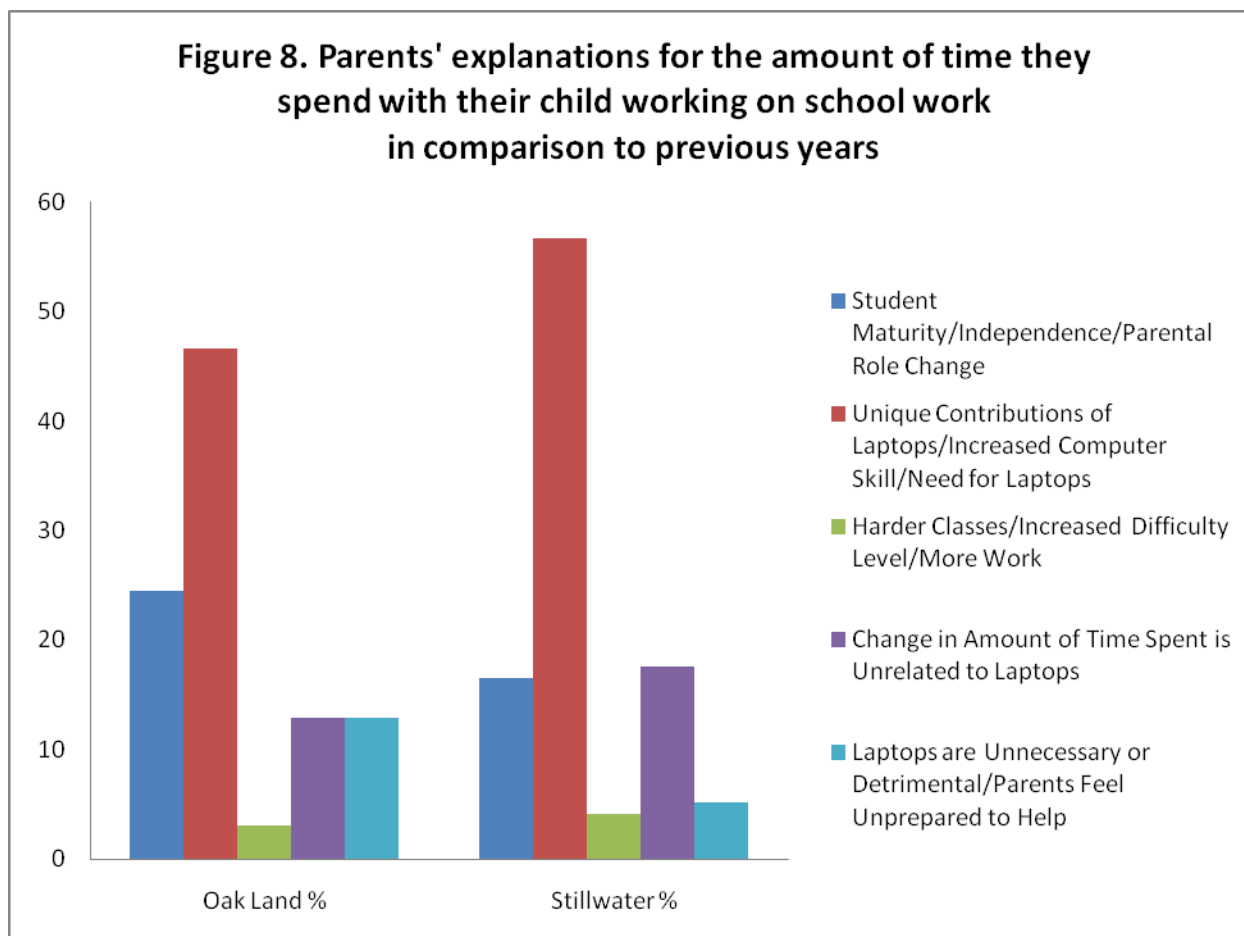
<u>Survey question</u>	Less time than before	About the same amount as before	More time than before
Now that you can check your child's assignments/class calendar online, how much time do you spend talking with your child about school work in comparison to previous years when you could not check their assignments/class calendar online?*			
SJHS	8%	31%	61%
OLJHS	14%	41%	46%
Now that you can check your child's grades online, how much time do you spend talking to your child about grades in comparison to previous years when you could not check their grades online?*			
SJHS	6%	28%	66%
OLJHS	13%	33%	53%
Given the level of access to technology that your child has, how much time do you spend with your child working on school work in comparison to previous years when your child did not have this level of access?*			
SJHS	29%	52%	19%
OLJHS	37%	43%	20%

*Indicates significant difference between schools at the .05 level in responses to this question.

Parents provided a great deal of information when they were asked to further explain their response to this survey question. Several categories emerged from analysis of their comments:

- Student Maturity/Independence/Parental Role Change
- Unique Contributions of Laptops/Increased Student Computer Skill/Need for Laptops
- Increased Difficulty Level/Harder Classes/Amount of Work
- Change in Amount of Time Spent is Unrelated to Laptops
- Laptops are Unnecessary or Detrimental/Parents Feel Unprepared to Help

Parents' open-ended responses to this survey question are copied verbatim and are provided as examples of various reasons why the amount of time has changed or remained the same.



Unique Contributions of Laptops/Increased Computer Skill

Both schools' largest category of open-ended comments (OLJHS 47%, SJHS 57%) for this question was about the unique contribution laptops have made to the amount of time they need to spend helping their students with homework. Parents' open-ended responses helped to further clarify why they spend less, the same, or more time working with their student on school work. In most cases, if parents checked "less time than before," their comments suggested that the laptops facilitated the student's taking responsibility for their own work. They were likely to state that their child has all of the resources he needs because they have a laptop and/or Internet access and therefore doesn't need as much help as he used to. Typical comments were,

Because the information is accessible, my child can most often find the answer for himself rather than asking me.

Our child seems to know the computers and technology better than we do! We try & help him when we can, and always offer support.

Parents who indicated they were spending "more time than before" were likely to make comments that suggested they were accustomed to using computers themselves. Some examples of parents' comments from this category were as follows:

Taking online practice tests, playing learning games or checking the teachers website makes it easier for me to get involved in his studying and makes it more pleasurable for both of us.

This allows me to be more involved in school than before. If my child isn't saying much about school, I can go online, see what she's studying, and ask direct questions regarding those subjects. In the past, if she didn't say anything, I just wouldn't...

Parents who checked "about the same amount of time as before" were likely to state that their level of involvement with homework has remained constant, but the computers allow them to monitor their student's progress. Examples of comments in this category were

technology does not replace involvement just aids the efforts

I don't have to work with my student more -- I can just be more aware of what he has to do and when, and I can remind him.

Student Maturity/Independence/Parental Role Change

Twenty-five percent of OLJHS and 17% of SJHS parents' comments to this question fell under the category of student maturity or independence and parental role change. Parents who offered open-ended comments in this category felt that their level of involvement had changed simply because their student had matured and become more independent and responsible as he got older. Sixty percent of OLJHS's parent comments in this area were from parents who stated that they spend less time on homework with their student now because their student had become more mature. Some examples:

more self sufficient - student takes more accountability for assignments

My child is better able to find the information by himself. Not necessarily because of the computer, but because he has matured.

He is working more independently, but may have made that shift even without the computer.

The other 16% of OLJHS parent comments that fell into this category were from parents who felt that they spent the same amount of time with their student because their student had always worked independently; therefore the amount of time the student needs from his/her parent on homework help has not changed:

My daughter does her homework just fine on her own so I only help her the same amount. When she asks for help I give it.

We've always had home access. My child is responsible and has never had an issue with homework completion, so little assistance is needed.

Of the 17% of SJHS parents' comments in this category, 63% were from parents who spend less time with their students on homework (*"my child is doing very well this year and has not needed my extra help"*), 31% were from parents who spend the same amount of time (*"I rarely spend time helping with school work. There really hasn't been much that my child has needed help with"*), and 6% were from parents who spend more time (*"She pays more attention to me when it's something that interests her"*).

Eighteen percent of SJHS parent comments and 13% of OLJHS parent comments for this survey question felt that the amount of time they spent with their children on homework was completely unrelated to laptop use. In other words, having a laptop or computer access or not is unimportant to the parents' degree of involvement with their student's school work. Most of the parents from both schools who provided comments in this category felt the amount of time they spent with their children on homework had not changed. For example, a comment from a SJHS parent who stated their amount of time hasn't changed: *"We have always been involved parents and this is not dependent on computer use."* A similar comment from an OLJHS parent: *"Expectation from my child to perform is very clear whether or not he / she has access to a computer."* Most parents who responded in this category felt that computer use and parent involvement are separate. If a parent provided a comment about increased involvement, it was likely due to individual differences among parents and students that the parent felt they needed to further explain.

Laptops Unnecessary or Detrimental

For some families, laptops present a barrier to spending time working with their students on homework. Parent comments that imply that laptops are detrimental to helping students with their school work or that indicate that parents feel unprepared to help their students with homework on the computer were 13% of OLJHS parents' comments and 5% of SJHS parents' comments. Some representative comments from OLJHS who help their students less (48%) as a result of laptops:

Because I do not know where everything is kept and my son does not have the patience to show me

I have found that it is harder for me to help my son with his homework when he's using a computer.

I acutally prefer work that needs to be written out. Assignments on the computer seem to have shorter answers and less thought involved,

paperwork can be done anywhere. We are not wireless at home. This at times can be a problem. No laptop no problem!

A representative comment from OLJHS parents who spend more time (29%) because they or their students have trouble using the laptops was, *"More time is needed to do homework because*

the lesson has to be learned along with the software tools to complete the assignment. Software usage is not intuitive and very time consuming.” Only a few SJHS parents thought laptops were unnecessary and answered that they spent the same amount or less time working on homework than previous years. For example, “We don’t work on schoolwork on the computer. We don’t have a computer at home and will not be getting one in the future. That should not be required!!”

Increased Difficulty Level in Classes

The smallest category of comments for both schools (OLJHS 3%, SJHS 4%) was the idea that classes have become more difficult and the amount of assigned homework has increased as students have moved from elementary to junior high. Some sample comments are

Teachers are giving a lot more homework than previous years and the kids get very little worktime, if any, to finish it.

Becasue the assinments are harder.

The level and amount of his homework has increased.

Parents’ Comments

Parents from both schools provided comments about their positive, negative, and mixed feelings about computer or laptop use in their child’s learning. Parent comments fell into these four categories:

- Positive
 - Laptop initiative, specifically
 - Laptop use generally, progress-monitoring
- Negative
 - Not available at the high school
 - Technical difficulties/No student computer training provided
 - Want old-fashioned education and handwritten work
 - Distracting
 - Too expensive
- Mixed
- Recommendations/Suggestions

Several sub-themes emerged in the positive and negative areas of laptop use for both schools that provided more information about why parents see laptops as positive, negative, or a mixed contribution to their student’s educational experience. The positive comments from both schools were either answered in a way that was specific to the particular laptop program (one-to-one or cart) in which their student is involved, or was more general in that the parents and/or their students love computers and enjoy monitoring the student’s progress online, regardless of program type. Both types of comments were useful in clarifying parents’ reasoning for endorsing, rejecting, or weighing the pros and cons of computer use for learning.

Of the OLJHS parents whose comments on laptop use were positive, 63% of those comments were about the 1-to1 laptop initiative specifically. The comments were about the value of having a computer or online access both in and outside of the school day. OLJHS parents made the following comments:

I think that it's a great addition to their normal routine at school. It not only helps them now but it can also help them in the long run. I think its a great thing to have at Oak-Land Jr. High School.

The 1 to 1 laptop initiative has enahnced my child's education by requiring my child to research for answers and sythesize the answers instead of highlighting a textbook that has only one answer.

I love this concept. Pls do whatever you can to keep this program up and running for these kids. The ability for them to have what they need helps them to be even more accountable. Even though my son is graduating 9th grad this year and will miss this it is fabulous! my main concern is the transition to high school without it

The computer laptop has been tremendous from many different aspects. We have noticed that it motivates the children to learn and grow as individuals compared to traditional methods. This was the best thing the district has done to facilitate learning.

The individual laptop was a wonderful experience for my child. We have multiple computers in our home on a wireless network, so for her to be able to just bring in her school computer and hook right into our home wireless was perfect.

My daughter has had a very positive response to the laptop initiative - she uses her laptop not just to complete assignments but research and keep organized by tracking her own assignments, grades and deadlines.

We have been very pleased with the one-to-one laptop program. Access to online resources at school, at the library, etc. via the laptop has been helpful in many subjects. Various programs have helped specific subjects as well

I think it is a fantastic tool that I wish all students could utilize, particularly at the secondary level. As a teacher in another district, I am sometimes envious of the things the O-L teachers are able to do with technology in their classrooms.

The laptop has been an invaluable tool! If only every kid in America could have this chance. What a great opportunity. I hope that Oak-Land keeps them for as long as possible so my other kids have this wonderful opportunity as well!!

The remaining 37% of the positive comments made by OLJHS parents were about how computers or online access to student homework and assignments enables parents and students to monitor progress or about how much they love computers:

my chiild loves his computer.

It is nice, in that I can check their grades when they say they don't know. Also it is easier to see if they have any missing assignments.

love on-line text books that are up to date, child having access to a computer in the family home, having assignments on-line to verify and complete missing assignments, immediate feedback of graded assignemnts, top notch tools in software and laptop tech

I think that computers are extremely important in their world. The earlier we can teach them more, the better... I also feel that way about teaching other languages though...

Very useful tool for learning.

Computers are definitely the answer to my son's learning. They have made learning fun

Its been positive. Writing was labor intensive and with the computer the mechanics are no longer an issue and he can focus on content.

Of the SJHS parents whose comments were positive, 77% love computers generally and find them useful for progress monitoring, and 22% would like to have a one-to-one program (more computer access). One percent of the positive comments were made specifically about the cart model. Some comments from SJHS parents who are in favor of laptop use generally:

I believe that the use of a laptop for research, Power Point presentations, writing and editing, and world language classes is a very important way for the child (and the school) to keep up with advancements in education and technology that may occur fast

I believe laptops in learning process can only have a positive effect.

Easier to transfer schoolwork from classroom to home and vice versa. Availability of calendar and grades online allows parent to be more informed and thus reduces what can be stressful talk about schoolwork with student.

We bought laptop for our daughter this past year. It is almost imposible to go through school without one. It is costly, but completely necessary for her education. Another child of ours is in high school, and she uses the computer daily

My son has become more involved and interested in learning. He loves the laptops at school and is a more active participant in the learning process.

If we don;t incorporate computers in learning they will use them solely for entertainment and socializing. It's good for them to know there are other purposes for computers than IMing!

We have a laptop at home so this has made doing schoolwork via internet very successful since we don't have the laptops that come back and forth to school as Oakland has. I believe the laptops in the school have enhanced the learning process greatly.

Here are some comments from SJHSpaents who are in favor of having a one-to-one program:

I think SJHS should be more like OLJHS (in laptop wise)

Every student at SJHS should be given a laptop to carry with them instead of heavy textbooks and multiple notebooks and folders.

Our son loves the use of the laptop at school, but wishes SJHS assigned laptops to students the way Oak-Land does. He often has difficulty getting programs and files downloaded properly to our home computer, and has been forced to submit assignments late.

I think SJHS is at a disadvantage when each classroom doesn't have their own computers. Classes have to share and teachers have to design the curriculum around when there class will have computers.

Our kids need access to computers in order to work in the market today. There are no jobs anymore that do not use technology - I wish both of the Jr. High's had full time access to computers!

While the laptop computer usage is great at school, we wish SJHS had a "take-home" program like OLJHS. It would be better if our son had the software to use at home, as our home computer is a bit different & he gets frustrated.

One comment in favor of the cart model:

The junior high program is wonderful! I hope they can continue to afford it and replace the computers in the carts as they age.

Both SJHS and OLJHS parents raised issues and concerns about how the use of laptops might be disadvantageous to student learning. The largest category of negative comments from parents at both schools was regarding technical difficulties or lack of direct computer instruction for students. Twenty-three percent of SJHS and 27% of OLJHS parents' negative comments centered on this issue. Some comments that OLJHS parents shared were as follows:

The specific laptop that was issued to my son was not working properly all year. We have had constant issues with blogs not being received from teachers. We still cannot get proper wifi connection from home even though we upgraded all home systems.

The benefits of the computer are limited by the degree to which the school locks down applications. We even had great difficulty loading printer drivers in order for my son to be able to print at home (very, very frustrating - I wasted a lot of my time).

She has been frustrated in not knowing how to type correctly and quickly. No time in school was ever focused on typing skills and correct typing skills are not emphasized. You don't give someone a tool and not teach them how to use it and have them practice.

No student computer should have any way of downloading music or other non-academic activity. Your security is very weak. Kids will find ways to hack these all the time. Servers going down every Sunday, lost file transfers to dropboxes,

I think too much is assumed by the school as far as parents computer abilities and not a lot of clear information is available about how to access the information used on the Oak-land Network if there is no wireless access at home.

Comments from SJHS on this issue:

Sadly enough, if the computer does not work at home, this means trips to the library. NETWORKS at school are not always consistently accessible.. Unfortunately, teachers can easily dump alot more on the students via the internet...

if our computer or internet is down, and the child didn't bring the book home because they were going to use the computer, OR there is no book except the online version, it is difficult.

It can be frustrating, trying to link things from home. It leads to tearful nights when that final project is due, and failed to link from home that night.....

Interestingly, 23% of SJHS's parent comments specifically stated that they did not want a one-to-one laptop program, which was a category of comment that only arose from SJHS parents. Some examples of comments in this category include:

I do not believe my child needs to have a computer/laptop issued from the school. By using our home computer he is less likely to hide in his room and we interact more as a family because everyone gets involved with his studies. It becomes a family affair.

I do not feel that my child needs a laptop provided by the school to have access to any of the things mentioned above. Access at school, at home is not dependent on the school providing a device.

I think there is a place for technology but it should not replace the text books. I am glad my student does not carry a laptop to and from school because with her backpack of typical stuff, gym bag and french horn (skis in the winter) and then adding a laptop

We currently have one child at SJHS, we moved b/c our other child attended OLJH with the lap tops....disaster. Grades tanked! Hated the take home lap tops with NO access to a hard cover book...we moved to avoid with child #2.

I think that having "unlimited" home access to computers and the internet is a necessity. I don't think that having an individual laptop at school would enhance my childrens' education.

Of the negative comments, the next largest category of concern for OLJHS parents (21%) was that the laptops are distracting for students, whereas 5% of SJHS parents who provided negative comments felt this was an area of concern. Some representative comments from OLJHS include:

It is a distraction and hurts their grades.

We have found that having the laptop decreased our child's attention in class and note taking.

Stop the one to one program! My kid is so tired of the computer. I will also think about not letting him use it next year at Oakland. He gets in to much trouble, but I don't blame him. What are we doing giving laptops to junior high kids.

They can play games and other non school related sites.

Comments from SJHS include:

The students can get into other areas and are not monitored during class time. I have seen pictures taken during class and I am very aware of internet ie, facebook, emailing during class time.

Both schools mentioned that they thought the laptops were too costly, with this type of comment comprising 17% of OLJHS's comments and 14% of SJHS's. Many of the comments about laptops being too costly center around the cost of repair, the distraction to students, or that money should be spent on teachers or elective courses instead. In the comments from OLJHS parents, 7% mentioned the need to bring back elective courses in comments such as,

I would prefer my kid to have elective choices then a laptop.

What ever happen to elective classes in 7th grade ?

Examples of comments from OLJHS parents regarding the expense of laptops:

Students play with the computers more then they learn with them. Complete waste of my tax dollar. I will vote no on any levy until lap tops are gone.

Get rid of the computers and save us taxes payers alot of money!!!!

My son continues to tell me about the misuse of computers, and all the damage and lack of respect for these computers. I have talked with many parents in the district and most of us feel this is a waste of money.

Here are some example comments from SJHS parents:

Computers and/or laptops are very expensive and the upkeep on them is expensive as well. I don't think every student needs their own laptop. A computer lab is good enough. The money should be spent on teachers NOT computers!

My key thought is that laptops that are purchased by the taxpayers for children to use are a factor in our problem with funding. I am very skeptical about whether kids learn better today than they did 100 years ago.

Some parents expressed interest in a return to traditional paper and pencil curriculum in which laptops are not a central part of everyday use. Thirteen percent of OLJHS parents comments and 23% of SJHS parent comments focused on a return to traditional formats for assignments and textbooks. Parents expressed concern that their children were losing their handwriting skills, that paper and pencil assignments were more reliable and less expensive. Some examples of comments from OLJHS parents include:

I would rather have less curriculum centered around online textbooks. I feel that students need to learn and research more the old frashioned way.

Concern handwriting may worsen. Not being used to modify curriculum by ability. If this were the case, I would see a positive impact. Disappointed in 7th grade science where focus is on remedial notetaking instead of labs and learning science.

I liked them not having the laptops because now she always stays in her room. I find it alot better for them to do there work on paper to because then i actually know that she did it and not just saying she did.

Example SJHS comments include:

I am concerned about the amount of time my child spends in front of the computer for homework.

I think there is a point when technology can be used too much. Kids have lots of time using electronics; I think it is enough. I would prefer that a lot of learning uses hands on and instruction and not be overly overwhelmed by technology.

I think writing skills (handwriting) have declined I see it as early as elementary school

Finally, 15% of OLJHS parents commented on the fact that the emphasis on technology does not continue at the high school, and 14% of the SJHS parents' comments made mention of that. Some examples from SJHS parents:

Would like to see laptops at the high school.

I believe that both Junior High schools should handle the laptops in the same way. Issue out or keep in school... When the students hit the HS, what is going to happen?

I think it's very important that they learn these skills. I do think that the Sr. High should be brought up to the techincal level that the Jr High's are at. If it isn't possible, then the techincal part should be done in Sr High.

Some examples of comments from OLJHS parents:

I don't like how they don't get computers next year. What are they going to do some kids never wright on paper and just type everything dose that help kids get used to the fact the they aren't going to be able to type every thing.

HAVING THE LAPTOPS FOR THREE YEARS AND THEN TAKING THEM AWAY IS DETRIMENTAL.

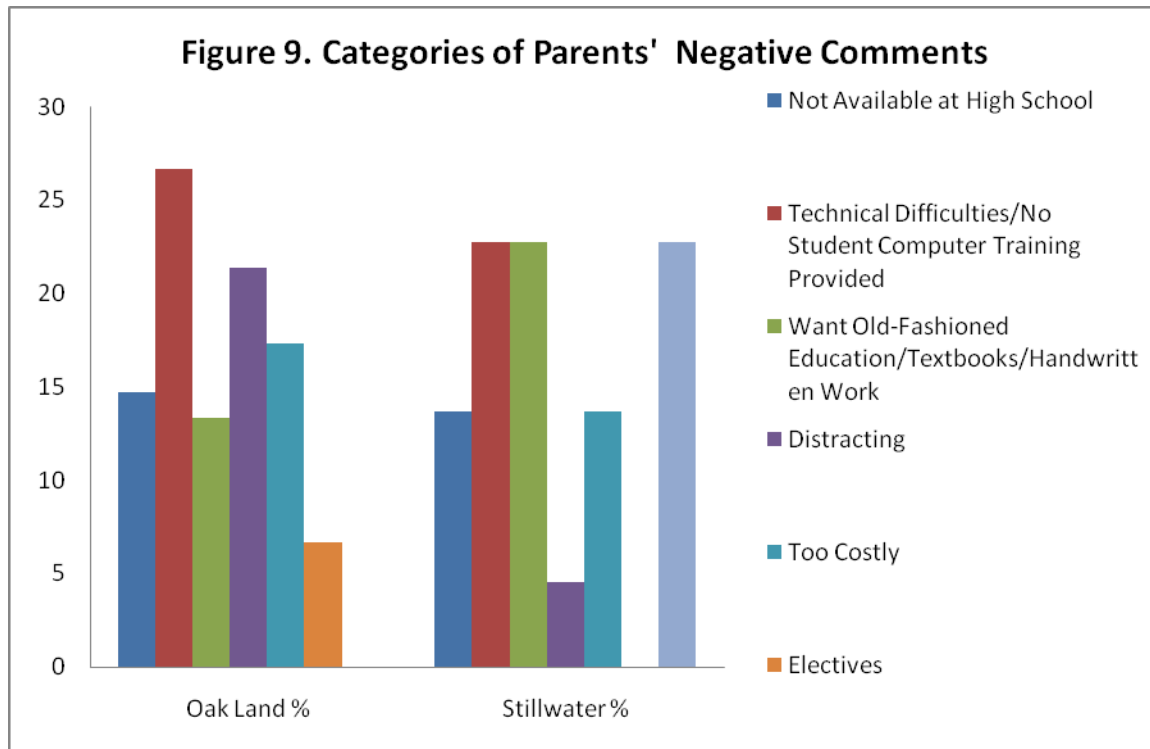
Should not punish students by taking computer away, he needs it to do well in school. As a student at OLJHS their academic life revolves around the computer, it is like taking their backpack away, you lose your calendar, assignments, resources.

We are NOT in favor of the laptop program. It would be better suited for a higher grade level, is too time consuming and expensive, has added stress on the students, complicates simple tasks such as turning in assignments (yes, they do get lost in cyberspace)

I think it's a wonderful addition and only wish it were available at the high school. It has made a tremendous difference in our daughter's self-esteem and ability to control her own grades and study habits because of ease of access to course work

I am really glad they can use these computers, it makes me sad that when they go to high school they won't have the same oppurtunity.

Overall, I think that the laptops are a positive, although it seems like the high school should have them over jr. high students. My son has certainly become more technology-minded since getting his laptop, the quality of his work has improved



Focus Groups with Sophomore Students

In February 2008 CAREI conducted focus groups with six groups of 10th grade students at Stillwater Area High School. Three of the groups included students who had attended SJHS and three groups included students who had attended OLJHS. Overall, 23 students out of the 60 that were invited participated in a focus group. Twenty-two students did not show up for their scheduled session and one student declined to participate after the researchers explained the purpose and procedures of the group. Some of the students who did not appear for their session were absent or told high school staff that they could not miss class because they had an exam.

The purpose of the focus groups was to collect information from students who, as junior high students, had experienced three years of the laptop initiative and now had had one semester of experience at the senior high school, which had a notably lower student/computer or laptop ratio than either junior high school. The results are organized by the following topics: student learning, student interest in a subject, communication with teachers and other students, and preparation for future careers.

Student Learning

Students were asked to think about how laptops were used in their junior high courses and now in their courses as sophomores and how their level of access might affect their learning in specific subjects. Interesting differences emerged among the subject areas of math, English language arts, social studies, and science. Students were most likely to say that laptops were helpful for their learning in math. A few students said the laptop could be a distraction. In contrast, students were least likely to say that laptops were helpful for their learning in English language arts. Students were positive about the use of laptops in their English language arts courses because it made typing papers easier, but they did not endorse the idea that the laptops improved their learning.

The effect of laptops on learning in science was a bit mixed. Students in four groups said laptops were helpful in science, but in the other two groups at least some of the students said laptops were not helpful for learning. The high achieving group from OLJHS was least likely to see a connection between laptop use and learning in science.

In three of the groups the students did not talk specifically about learning in social studies due to time constraints in the session. Students in two of the other three groups said laptops helped their learning in social studies and students in the third group said laptops could be helpful but they needed a mix of laptops and paper materials.

The brief survey students completed at the end of the focus groups also provided information on how laptop access might affect student learning. As students looked back to elementary school, then junior high school, and now high school, the majority (87%) thought computer access changed their grades some or a lot (Table 53). Sixty-eight percent of the students said the change was in a positive direction. Over one-fourth (27%) said the change was in both a negative and positive direction.

Table 53. Results of brief questionnaire.

	Number of Students	Percent of Students
How much did computer access change your grades? (N=23)		
A lot	9	39%
Some	11	48%
Very little	2	9%
Not at all	1	4%
In which direction? (N=22)		
Negative	1	5%
Positive	15	68%
Both Negative and Positive	6	27%

The survey also asked students to list the subject(s) in which laptop access affected their grades. Students who said laptop access had changed their grades a lot in a positive direction listed multiple subjects. Social studies was listed most frequently, but students also mentioned world languages, math, English language arts, and science. One student said laptop access had changed their grades in all subjects because “*access to the school website and current homework and grades and information about missing assignments were always available.*”

Students who said laptop access changed their grades some in a positive direction also listed multiple subjects. English language arts appeared most frequently. Students also listed world languages, social studies, music, math, and science. One student said laptop access had a positive effect on almost everything because “*it just made me dig deeper or do more work.*” Another explained that laptop access was helpful in math and science because “*you can see the problem and the answer.*”

Math was mentioned most often among the students who said laptop access had changed their grades some or a lot in both a negative and positive direction. Some students provided further information about the changes

It helped a lot in art and video production. Some in science and social studies. No so much in math.

In math I may have been distracted by the Internet and trying to work around the blocks so I could listen to music.

The single student who said laptop access had changed his/her grades a lot in a negative direction also said the change occurred in math and science.

Student Interest in a Subject

Students were also asked to reflect on how access to laptops might affect their interest in a subject area. Most of the students thought laptops had a positive effect on their interest in science and English language arts. The students who said that laptop access did not affect their interest in

science explained that they had never liked science and having a laptop in the course did not make a difference in their interest level. Students talked enthusiastically about the projects they did in junior high English language arts using a variety of software programs. They contrasted that with their high school courses where computer use is limited to typing up papers at home.

Many students mentioned a Google Earth project they did in ninth grade when asked about laptops and their interest level in social studies. They explained that the laptops increased their interest because they “didn’t need to sit around all the time.” Students’ comments about laptop use and their interest in math depended on how the laptops were used in a course. Several students noted that the repetition of a program called Cognitive Tutor was annoying and they felt the repetition made them distracted. In contrast, students who used laptops and software in geometry said the software made the subject more interesting.

Students were also asked if access to laptops encouraged them to dig deeper in a subject that was required for their courses. Students were most likely to go beyond what was required in science courses. For example, students said

The videos, if they’re interesting then you go around and look at other stuff.

I only used the computers once, but we went through a lab a couple times so we could go back and redo it if you didn’t understand it the first time. Without the mess.

You got to pick a topic and then using a computer you could research all of them if you wanted.

Students also described how they used a laptop to explore something that had piqued their interest during an English language arts course. As one student explained, “*I can look up an author I like to see if they have other books.*” The students were less likely to explore topics further in social studies than in science and English language arts. In one of the high achieving groups students described “getting really interested in politics” or using a laptop to read the newspaper a lot. In the other groups students were less enthusiastic and said if they used a laptop it was to better understand the content the teacher was covering rather than dig deeper into a topic because they were interested in learning more.

Students were least likely to use a laptop to explore math topics beyond what was being covered in class. An exception was students in a geometry course that said they got really interested in shapes because they could rotate them on the computer. One student drew a contrast beyond exploring further in science and math: “*There’s a bunch of stuff you can look up in science and in math there’s nothing.*” Another student said the following about math: “*Math was pretty basic. We didn’t need to find any background information for it.*”

As the students talked they explained that in some cases a lack of time kept them from going deeper into a topic. During class they might have little or no time to go beyond what is required and by the time they get home they may have forgotten or become interested in something else.

As one student said, *“You’re interested at school but something might happen between school and home and you might forget it.”*

Communication with Teachers and Other Students

In addition to exploring how access to laptops might affect students’ interest in a subject and their learning, researchers also asked students how laptop access might affect communication with teachers and other students. Across the six groups the students concurred that it was easier to email teachers if they had their own computer or laptop at home. The students explained that most of their email contact with teachers in junior high school took place when the students were at home, rather than at school. They said being able to email teachers was useful because passing time was so short that students didn’t have time to ask teachers questions after class. Typically, students indicated that they might have contacted a teacher to inquire about a missing assignment, ask a question the night before a test, find out about an assignment if they were sick and had missed class, or turn in an assignment. An exception was one group where students also mentioned that their science teacher had IM open the night before a test so they could quickly get an answer as they studied. Many students suggested that their parents were more likely to contact their teachers than the students themselves.

The students didn’t think laptop access had increased their communication with other students. Because students were generally not allowed to email their peers during school, any email contact with their peers had to occur when students were at home. Students in one group described how they had done a blog as part of an assignment and, in that case, they were able to communicate with other students via the Web during the school day. Some students said they may have contacted a peer from home to get information on a homework assignment and others said that if they contacted another student from home it would have been to talk about other things unrelated to school work.

Several students commented on the planner and how useful it was in junior high to check on their assignments and grades. Former SJHS students mentioned that they missed the capacity for file transfer that was available on their junior high planner.

Preparation for Future Careers

Students described two ways that access to computers and laptops in junior high helped them prepare for future careers. First, they indicated that learning how to use computers and different software programs prepared them for future jobs where they might need similar skills. Second, they described how they had gathered information about careers that interested them by doing research on the Internet.

Summary and Discussion of Focus Group Results

The focus groups with sophomores who had experienced three years of the laptop initiative as junior high students indicated that the relationship between laptop access and variables such as student learning, student interest in a subject, and student grades is complex. Factors such as how teachers use the laptops in their courses and the relative narrowness of a curriculum area, such as math, play a role in how laptops will affect student interest and their learning in a course. The student comments suggested that access to laptops is only one factor of many that influence the

quality of instruction. It is possible to have poor instruction with laptops and it is also possible to have good instruction in the absence of laptops. There were no consistent differences in the results between students who had attended SJHS and students who had attended OLJHS. Nor were there any consistent differences between students of low, middle, and high achievement levels.

◆ Summary and Discussion

The overall goal of the study was to collect information about how the laptop initiative may have affected teaching and learning. Several different data collection methods were used to gather data from students and teachers at SJHS and OLJHS, and parents of students at SJHS and OLJHS. The study results detailed numerous ways in which the laptop initiative may have had a positive influence on teaching and learning. The results of the study should not be used, however, as evidence of a causal relationship between the use of computers and laptops and changes in teaching and learning. Many other factors in addition to, or in place of, the use of computers and laptops may have affected the outcomes described in this report. To estimate the potential influence of other factors would have required the inclusion of a comparison school in the study design that was similar to both SJHS and OLJHS, but did not have laptops available to students. This type of design was not feasible within the scope of this study. Nonetheless, the study provides a detailed portrait of teaching and learning in a laptop environment.

When interpreting the study results it is important to keep in mind that data from the surveys and interviews were based on the self-report of students, teachers, and parents. As with any self-report measure in any study, people may have, intentionally or not, provided the response options that they thought would make them or their school look best. To reduce this possibility, teachers, students, and parents in this study completed the surveys anonymously. The evaluation design also included researcher observations of classroom instruction with computers or laptops to serve, in part, as a check against the possible bias of self-report. Although the scope of the information gathered through the classroom observations was not as broad as the scope of the student and teacher surveys or the teacher interviews, a qualitative comparison of the results among these data sources did not reveal any substantive differences that would suggest bias.

Teaching

The results indicated that the laptop initiative contributed to enhancements in the quality of teaching at both SJHS and OLJHS. Through surveys and interviews teachers provided many examples of how their instruction and preparation for instruction had changed in ways that benefited students. Data from researchers' observations of classroom instruction showed that the quality of instruction was high at both SJHS and OLJHS.

Facilitation of Students' Higher Order Thinking. Information from multiple sources indicated that the laptop initiative expanded teachers' capacity to facilitate students' higher order thinking. On the teacher survey, over three-fourths of the teachers (84%) said access to a computer or laptop contributed some or a lot to students demonstrating more higher-order thinking. In interviews with the researchers, teachers readily described how their instruction had changed to incorporate more learning activities that helped develop students' critical thinking skills. When the researchers observed instruction that incorporated the laptops they found that the level of higher order thinking was high in both schools. They also found strong use of disciplinary knowledge in the instruction. Students and teachers were addressing the central ideas of a discipline or topic thoroughly and exploring connections and relationships to produce deep understanding.

Instruction. The laptop initiative also supported changes in other areas of teacher practice. Ninety-four percent of teachers said they were better able to access diverse teaching materials and resources when students had access to computers or laptops. Further, 90% of the OLJHS teachers and 81% of the SJHS teachers agreed with the statement, “When I know that my students will have access to computers or laptops I am better able to individualize my curriculum to fit student needs.” Ninety-one percent of teachers agreed that a laptop helps them to access more up-to-date information for their students, 90% of teachers agreed that through the use of computers or laptops students are able to explore topics in greater depth, and 90% of teachers agreed that having computers or laptops in the classroom helped them create materials that better meet district goals.

The survey results were consistent with data from teacher interviews. During interviews with the researchers, most of the teachers offered examples of how their instruction had changed in the following areas:

- instruction became more student-centered;
- students had more opportunity to actively explore information; and
- instructional content was more up-to-date and interesting for students.

The teachers were less likely to remark on change in how often students collaborated in their learning. For most of the teachers, the laptop initiative seemed to facilitate changes in practice that were consistent with their existing beliefs about effective instruction. The teachers did describe, however, how students’ access to laptops had made it easier to implement instructional strategies they had long valued, such as reducing the amount of time they spent lecturing and instead, asking students to find information and synthesize it to form conclusions.

Data from the teacher survey also demonstrated how the laptop initiative influenced teachers’ instruction and preparation for instruction. Teachers reported that, in the classroom, students were most likely to use computers or laptops to do the following:

- manage and analyze information;
- research information using the Internet; and
- work on short-term assignments/worksheets.

Teachers reported using their laptops most often to do the following: communicate with colleagues, manage student information, communicate with parents and students, and develop instructional materials. Some teachers also acknowledged challenges that can occur when students have access to computers or laptops. Although two-thirds of the teachers agreed with the statement “When we are using computers or laptops there is less classroom management that needs to take place,” one-third disagreed with the statement. When asked if using computers or

laptops in the classroom increased their workload, the teachers' responses were split nearly half and half between agree (51%) and disagree (49%).

From a more holistic perspective, some interesting ideas emerged about how the introduction of laptops might change instructional practice and teacher beliefs about effective instruction. One surprise to CAREI researchers was that, as one teacher said, even teachers who have a student-centered teaching philosophy can be helped by laptops. There are things laptops facilitate—things even the best teacher may have long wanted to do but were not possible before laptops.

Teachers for the most part believe that laptops increase students' interest and engagement in learning activities. It is important to remember that the teachers who were invited for interviews and whose classrooms were observed were intentionally selected because they were strong users of technology. A look at teachers as a whole may balance that somewhat with concern about how laptops can be distracting. Nonetheless, in the interviews teachers explained how the use of laptops makes instruction more interesting to students. They have more choices, both in terms of where they look for information and in how they present their work. Teachers can more easily make instruction relevant to students' lives and current events because they can access up to date information more easily on their own laptops and can send students out via their laptops to get current information. Neither teachers nor students are limited any longer to what's in the textbook or school library.

Content of the Curriculum. Results from the teacher survey suggested a positive relationship between the laptop initiative and the content of the curriculum. Eighty-four percent of the teachers agreed that they were better able to meet their curriculum goals when students were using computers or laptops. In observations of instruction with laptops at both schools, researchers found that a high proportion of the students were focused on the intended curriculum objectives when using the laptops. In addition, the technology use in the lesson represented learning activities that could not otherwise be easily done. These results provide evidence that the laptops are being used to enhance the curriculum rather than serving as an add-on to the standard curriculum.

Students

The study results also offered evidence of how the use of computers and laptops can benefit student learning. Students and teachers at both schools reported advantages for students that were associated with the laptop initiative.

On-Task Classroom Behavior and Student Engagement. Information from several sources suggested that student engagement was higher when students had access to computers or laptops. On the teacher survey, 90% of the teachers said students show greater engagement in the task when they are using computers or laptops. When researchers observed instruction, they found that students' physical engagement in the lesson was high at both 15 and 30 minutes into the class period. The survey results also showed that teachers believe students explore topics in greater depth when they have access to computers or laptops.

Another indicator of students' engagement in learning is how often students use a laptop to learn things beyond what teachers have assigned in class. Fifty-five percent of the SJHS students and 60% of the OLJHS students said they use the laptop to learn about things not assigned in class. When asked to comment on this use, the majority of the students at both schools described how they used their laptops to pursue their curiosities once their interests were piqued about a topic. This suggests that students' access to technology could spark or, at minimum, support the development of life-long learning practices and perspectives.

Many students associated positive effects with their use of computers or laptops. For example, 93% of the SJHS students and 92% of the OLJHS students agreed when asked if they were more likely to revise/edit their work when it was done on a computer or laptop. Ninety percent of the students at both schools agreed that having access to a computer or laptop helped them be better organized.

Opinions about the Use of Laptops. Students' opinions about the laptops, as measured by their responses on the student survey, were very positive. Many students associated positive effects with their use of computers or laptops. For example, 93% of the SJHS students and 92% of the OLJHS students agreed when asked if they were more likely to revise/edit their work when it was done on a computer or laptop. Ninety percent of the students at both schools agreed that having access to a computer or laptop helped them be better organized. Only a small percentage of students at each school indicated that they wanted to use laptops in school less than they do now. Similarly, only a small proportion said that they wanted to use a computer or laptop for homework less than they do now.

Communication Between Teacher-Student and Student-Student. Student access to a computer or laptop was more likely to increase their frequency of communication with teachers when students were at home than when students were at school. On the student survey about one-third indicated that they communicated more with their teachers when they had access to a computer or laptop at home. The effect on students' communication with their peers was similar. About half of the students indicated they communicated more with other students about school projects and assignments when they were at home. When asked about communication with their peers while at school, over one-third reported a higher frequency of communication when they had access to a computer or laptop.

Achievement. With one exception, statistical analyses of the growth in student achievement in reading and mathematics during junior high revealed no statistically significant differences between students at SJHS and students at OLJHS. SJHS students who began 7th grade in fall 2006 had a higher rate of growth in reading achievement from fall 2006 to fall 2007 than their peers at OLJHS. The estimated average score on the reading test for SJHS students was 219.8 in fall 2006 and 224.4 in fall 2007. In contrast, the estimated average score on the reading test for OLJHS students was 222.1 in fall 2006 and 225.1 in fall 2007. The results suggest that neither the one-to-one model nor the cart model of laptop access detract from students' performance on standardized assessment measures.

Parents

Results from the parent survey illustrated how parents and their children have benefited from the initiative. One component of the laptop initiative was providing parents and students with the means to access students' homework assignments/class calendar and grades online and at least three-quarters of the parents surveyed indicated that they used this service. Eighty-five percent of the SJHS parents and 58% of the OLJHS parents said it was very important for them to have online access to their child's assignments/class calendar and grades.

Over three-fourths of the parents at each school reported that they had worked on schoolwork with their child using a computer. Most often the parents reported working with their child to edit a paper or research information. This suggests that parents are not discouraged from helping their child with schoolwork, even though it may require knowledge of computers and software. It appears that although there could be some new skills or insights that parents may need to help their student(s) with homework, parents are not opposed to this challenge.

Sixty-one percent of the SJHS parents and 46% of the OLJHS parents said they spend more time talking with their child about school work now in comparison to previous years when parents could not check students' assignments/class calendar online. When asked how the availability of online grades affected their communication with their child, 66% of the SJHS parents and 53% of the OLJHS parents indicated that they now spend more time than before talking with their child about grades. In both cases, the proportion of SJHS parents who said they now talked with their student more than before was significantly higher than the proportion of OLJHS parents.

Comparisons Between the 1:1 and 3:1 Student-to-Laptop Ratios

Given the different student-to-laptop ratios at SJHS and OLJHS, a secondary focus of the study was to explore potential differences in how the laptop initiative, among other factors, may have affected teaching, learning, and parents at each school. Statistically significant differences occurred in several areas. Teachers at SJHS were more likely to report that access to a computer or laptop in the classroom contributes a lot to students' interest in class. SJHS students were more likely to say that using a computer or laptop, at school or at home, makes schoolwork more enjoyable. As noted earlier, SJHS students were also more likely than OLJHS students to indicate that they'd like to use laptops in school more and use a computer or laptop for homework more. Forty-four percent of SJHS students said they do not have enough access time on a computer or laptop at home to work on their homework. A higher proportion of OLJHS teachers agreed with the statement "there is more open communication between students and teachers in classrooms when computers or laptops are in use." OLJHS teachers were also more likely to agree that students' access to computers or laptops made it easier for them to individualize the curriculum to fit student needs and more able to cover more material in class. Notable differences occurred as well on the parent survey results. SJHS parents checked their child's assignments and grades online significantly more often than OLJHS parents and a higher proportion of SJHS parents said it was very important for them to have online access to assignments and grades.

Overall, there were relatively few statistically significant differences between the survey results for SJHS teachers and OLJHS teachers. Given OLJHS students' relatively unlimited access to a laptop, it was anticipated that OLJHS students would be more likely to use a laptop for writing first drafts of papers or for editing papers. Or, that OLJHS teachers would be more likely than SJHS teachers to report that their instruction had become more student-centered since the laptop initiative began, or that they had increased the amount of critical thinking and collaborative work students were required to do in their courses. The results did not match these expectations, however.

Data from teacher interviews and classroom observations also did not reveal clear distinctions in teaching and learning between the one-to-one model and the cart model of laptop access. In many areas on the survey, the differences that did occur between the schools were differences in teachers' level of agreement with a statement rather than differences between agreement and disagreement with a statement. For example, Table 54 shows how teachers from each school responded to a question about how the use of computers or laptops affects the quality of their students' work. The most notable difference in how SJHS and OLJHS teachers responded was the difference in the proportion of teachers that selected "somewhat agree" or "agree" for their answer, rather than the difference in the proportion of teachers that disagreed or agreed, at some level, with the statement.

Table 54. Quality of student work, by school.

Survey question: <i>"Indicate how much you agree or disagree with each of the following statements."</i>	Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree
The quality of my students' work increases when we use computers or laptops.						
SJHS	4%	4%	11%	43%	25%	14%
OLJHS	8%	3%	3%	33%	40%	15%

One complication in attempting to identify clear differences between the one-to-one model and the cart model is that, in some cases, the differences between the schools were in the opposite direction of what would be expected given OLJHS students' relatively unlimited access to a laptop computer. For example, SJHS teachers were significantly more likely to report that students published content to the web as part of their ongoing work and significantly more likely to report that students used computers or laptops to create culminating projects to show what they have learned. SJHS teachers were also significantly more likely to indicate that computer or laptop access in the classroom contributed a lot to students' interest in class. And, SJHS students were more significantly likely than OLJHS students to strongly agree with the statement "I am more likely to revise/edit my work when it is done on a computer or laptop."

Interpreting the school to school comparisons is also complicated by the low survey completion rates, and, in particular, the low completion rates for SJHS students and parents, relative to the OLJHS completion rates for these surveys. Because SJHS students don't take school laptops home, those students and parents who completed the survey may have been more likely to be

those that have easy computer and Internet access at home. This difference, in turn, may have made their experiences in the laptop initiative different from the group of SJHS students and parents as a whole.

On the other hand, potential differences between the one-to-one model and the cart model regarding teaching and learning may have been minimized by the large proportion of SJHS students who had computer and Internet access at home. Well over three-fourths of the SJHS students (88%) reported that they have access to a working computer or laptop at home and 91% said that computer or laptop was connected to the Internet. In addition, although the cart model didn't give SJHS students access to a laptop beyond the classroom, the 3:1 student-computer ratio in the cart model at SJHS may not have been sufficiently different from the 1:1 student-computer ratio at OLJHS to produce statistically significant differences in teaching and learning as measured in this study.

As mentioned earlier, the results from interviews and classroom observations with a sample of teachers at each school who were considered strong technology integrators also did not show any differences in teaching between the schools. A closer examination of the combined interview data from both schools, however, revealed some interesting ideas about how the introduction of laptops might change instructional practice and teachers' beliefs about effective instruction. For example, several teachers suggested that even if a teacher's beliefs about instruction supported student-centered instruction, student access to laptops could still affect that teacher's practice by making it easier to put students at the center of learning activities. Teachers also talked about the role shift that occurred in the classroom when teachers are less knowledgeable about a particular software program or laptop function than the students: "It has also brought the students to the teachers. For example, this morning we had a meeting about using a probe, bringing some science equipment into the math classrooms. I said 'No, I don't have training on this equipment' and someone said 'Go to the students.'" As students step up and help their teachers or other students with laptops and other technology, students and teachers may become more comfortable with students functioning as teachers and this may carry over to other areas of the course. Students may gain confidence in their level of knowledge about laptops and other technology and find satisfaction in taking more initiative for their own learning beyond the area of technology.

Several teachers discussed how powerful it could be for teachers who were reluctant to integrate laptops into their instruction to see their students working on laptops and notice how engaged and creative they were. As noted in research on effective professional development for teachers, seeing how a new tool or strategy affects their students in their classroom is a more persuasive argument for most teachers than hearing another adult tell them "This is a good strategy. You should do more of this." Although many teachers described how laptops facilitated positive changes in their instruction, the laptop initiative seemed to have less effect on the content of the curriculum. Some teachers commented that they used the laptops less in courses that had more prescriptive content, such as an Advanced Placement course or courses that were closely linked to district or state tests.

The survey completion rates suggest caution in generalizing the results to all students and teachers at SJHS and OLJHS, and all parents of students at SJHS and OLJHS. As noted earlier, 20% of the students at SJHS and 60% of the students at OLJHS completed the survey. A comparison for each school of the characteristics of students enrolled and students who completed the survey identified some differences between these groups. For both schools, 7th grade students were overrepresented and 9th grade students were underrepresented in the group of respondents. Eighth grade students were also underrepresented in the respondent group at SJHS. As a result, the survey findings may not fully reflect the experiences of all junior high students, especially 8th grade students at SJHS and 9th grade students at either school. Differences between OLJHS students and SJHS students in terms of how easily students could access a computer or laptop to complete the online survey may have contributed to the lower response rate at SJHS, and may have influenced the results towards SJHS students who have more frequent access to a computers or a laptop relative to their peers. Because OLJHS students each have their own laptop they could complete the online survey at almost any time. In contrast, SJHS students who wanted to complete the survey would have had to come into school early or stay after school to access the school's computer lab, unless they had sufficient access to a computer or laptop at home that had Internet access at a speed conducive to taking an online survey.

The completion rate for the parent survey was low at both schools; 17% of SJHS students' parents and 31% of OLJHS students' parents completed the survey. As a result, the study results may not fully portray the perspectives of all junior high parents. The survey respondents affiliated with either school may be more likely than their non-respondent peers to have easy access to a computer that is connected to the Internet and this may have influenced their experiences in the laptop initiative, and therefore their survey responses.

The completion rate for the teacher survey was the highest among the three surveys. Almost half of the SJHS teachers (47%) and over two-thirds of the OLJHS teachers (71%) completed the survey. Nonetheless, caution is needed in generalizing the survey results to all teachers, especially at SJHS. However, the wide range of responses from SJHS teachers concerning the number of days their students had used laptops in the classroom this year indicated that the group of respondents was not over-represented by teachers who were frequent users of the laptop carts. This suggests that despite a completion rate of less than 50%, the results for SJHS teachers may represent a range of teacher experiences in the laptop initiative.

In sum, the study data offer numerous examples of positive changes that teachers and students have observed in teaching and learning when computers or laptops are made available to students. Parents and students have also benefited from online access to information about their students' assignments and grades. The implications of the study data are less obvious, however, when comparisons are made between the one-to-one model and the cart model. Further study may be needed to clarify potential similarities and differences between the models regarding their influence on teaching and learning.

◆ References

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Appendix

Table 1. Descriptive statistics for cohort I: All students.

OLJHS Fall 04, Cohort I, Grade 7	N	Minimum	Maximum	Mean	Standard Deviation
Math Percentile	305	2	99	69.52	22.886
Math Score	305	187	260	231.48	12.777
Read Percentile	305	2	99	67.89	23.040
Read Score	305	176	246	222.74	10.396
SJHS Fall 04, Cohort I, Grade 7					
Math Percentile	321	6	99	70.40	23.528
Math Score	321	195	271	232.06	13.147
Read Percentile	323	7	99	66.78	22.792
Read Score	323	191	247	222.59	9.921
OLJHS Spring 05, Cohort I, Grade 7					
Math Percentile	289	6	99	67.37	22.918
Math Score	289	198	278	238.22	14.196
Read Percentile	295	3	99	66.14	23.329
Read Score	295	187	252	226.47	10.158
SJHS Spring 05, Cohort I, Grade 7					
Math Percentile	311	5	99	67.27	23.625
Math Score	311	197	272	237.89	14.163
Read Percentile	323	4	99	66.06	23.133
Read Score	323	191	254	226.62	10.018
OLJHS Fall 05, Cohort I, Grade 8					
Math Percentile	301	2	99	67.58	24.411
Math Score	301	192	276	238.52	13.224
Read Percentile	302	1	99	69.78	22.649
Read Score	302	179	252	227.15	9.839
SJHS Fall 05, Cohort I, Grade 8					
Math Percentile	336	1	99	67.07	25.273
Math Score	336	179	277	238.34	13.893
Read Percentile	333	2	99	70.93	22.876
Read Score	333	184	262	227.95	10.286

Table 1. Descriptive statistics for cohort I: All students (continued).

OLJHS Spring 06, Cohort I, Grade 8	N	Minimum	Maximum	Mean	Standard Deviation
Math Percentile	300	1	99	71.92	23.633
Math Score	300	181	287	247.00	14.924
Read Percentile	301	2	99	69.48	21.802
Read Score	301	184	259	230.28	9.562
SJHS Spring 06, Cohort I, Grade 8					
Math Percentile	291	7	99	73.19	23.792
Math Score	291	204	285	247.67	14.515
Read Percentile	330	2	99	70.63	22.724
Read Score	330	186	260	230.91	9.763
OLJHS Fall 06, Cohort I, Grade 9	N	Minimum	Maximum	Mean	Standard Deviation
Math Percentile	346	1	99	66.45	27.459
Math Score	346	187	298	241.97	16.467
Read Percentile	23	1	45	19.87	14.555
Read Score	23	176	221	205.78	13.142
SJHS Fall 06, Cohort I, Grade 9					
Math Percentile	384	2	99	68.89	27.321
Math Score	384	192	288	243.83	16.064
Read Percentile	29	4	90	26.45	19.303
Read Score	29	193	237	211.48	9.734
OLJHS Spring 07, Cohort I, Grade 9	N	Minimum	Maximum	Mean	Standard Deviation
Math Percentile	31	3	66	21.68	15.802
Math Score	31	198	246	220.52	12.591
Read Percentile	29	1	50	19.83	15.000
Read Score	29	176	225	208.45	12.897
SJHS Spring 07, Cohort I, Grade 9					
Math Percentile	2	1	1	1.00	.000
Math Score	2	192	193	192.50	.707
Read Percentile	30	4	82	34.27	21.301
Read Score	30	193	236	217.83	10.399

Table 2. Descriptive statistics for cohort II: All students.

OLJHS Fall 05, Cohort II, Grade 7	N	Minimum	Maximum	Mean	Standard Deviation
Math Percentile	222	1	99	76.26	20.632
Math Score	222	174	258	236.57	12.153
Read Percentile	218	2	99	74.31	22.463
Read Score	218	177	246	225.63	10.584
SJHS Fall 05, Cohort II, Grade 7					
Math Percentile	256	8	99	76.34	20.380
Math Score	256	200	266	237.24	11.289
Read Percentile	250	2	99	76.04	21.077
Read Score	250	177	253	226.61	9.912
OLJHS Spring 06, Cohort II, Grade 7					
Math Percentile	214	1	99	77.70	20.969
Math Score	214	182	272	243.97	13.592
Read Percentile	214	1	99	76.03	20.208
Read Score	214	170	252	229.70	10.019
SJHS Spring 06, Cohort II, Grade 7					
Math Percentile	241	3	99	79.02	18.763
Math Score	241	193	272	244.83	11.550
Read Percentile	255	4	99	76.79	20.782
Read Score	255	189	258	230.62	10.095
OLJHS Fall 06, Cohort II, Grade 8					
Math Percentile	347	1	99	66.12	27.291
Math Score	347	162	282	237.51	15.873
Read Percentile	343	1	99	65.17	26.527
Read Score	343	157	258	225.06	12.083
SJHS Fall 06, Cohort II, Grade 8					
Math Percentile	370	3	99	66.54	26.550
Math Score	370	194	281	238.15	14.530
Read Percentile	370	1	99	67.67	26.691
Read Score	370	168	252	226.28	12.489

Table 2. Descriptive statistics for cohort II: All students (continued).

OLJHS Spring 07, Cohort II, Grade 8	N	Minimum	Maximum	Mean	Standard Deviation
Math Percentile	125	1	85	42.26	21.012
Math Score	125	158	252	228.96	14.041
Read Percentile	40	1	71	22.30	15.068
Read Score	40	181	230	209.33	10.403
SJHS Spring 07, Cohort II, Grade 8					
Math Percentile	120	3	97	39.82	20.695
Math Score	120	196	263	228.48	11.682
Read Percentile	121	1	99	45.00	27.615
Read Score	121	177	248	218.97	13.532
OLJHS Fall 07, Cohort II, Grade 9					
Math Percentile	198	1	99	64.91	21.541
Math Score	198	155	265	239.72	12.655
Read Percentile	24	1	92	22.33	22.025
Read Score	24	158	238	205.62	16.965
SJHS Fall 07, Cohort II, Grade 9					
Math Percentile	390	2	99	68.14	26.090
Math Score	390	192	278	242.72	14.521
Read Percentile	26	1	54	15.31	13.035
Read Score	26	179	224	203.04	11.847

Table 3. Descriptive statistics for cohort III: All students.

OLJHS Fall 06, Cohort III, Grade 7	N	Minimum	Maximum	Mean	Standard Deviation
Math Percentile	343	1	99	63.17	26.418
Math Score	343	181	261	230.38	14.225
Read Percentile	342	1	99	64.73	27.177
Read Score	342	154	250	221.46	13.055
SJHS Fall 06, Cohort III, Grade 7					
Math Percentile	326	7	99	65.00	24.463
Math Score	326	199	274	231.71	12.818
Read Percentile	326	2	99	64.84	25.552
Read Score	326	180	244	221.68	11.134
OLJHS Fall 07, Cohort III, Grade 8	N	Minimum	Maximum	Mean	Standard Deviation
Math Percentile	339	1	99	63.88	27.839
Math Score	339	176	266	236.04	15.987
Read Percentile	340	1	99	64.06	28.125
Read Score	340	163	248	224.16	13.810
SJHS Fall 07, Cohort III, Grade 8					
Math Percentile	351	2	99	64.51	25.895
Math Score	351	193	269	236.90	14.071
Read Percentile	343	1	99	67.45	25.799
Read Score	343	178	252	226.25	11.215

Table 4. Descriptive statistics on the reading test for cohort I: Students in the lowest quartile

Semester	School	N	Median Score	Mean Score	SD Score	Median Percentile	Mean Percentile	SD Percentile
Fall 04	OLJHS	20	202.5	198.95	8.769	19.50	16.80	7.317
Fall 04	SJHS	17	203.00	201.59	4.691	20.00	18.59	5.702
Spring 05	OLJHS	19	208.00	208.05	8.554	21.00	24.05	14.868
Spring 05	SJHS	14	210.50	211.36	6.356	25.00	28.79	13.779
Fall 05	OLJHS	17	209.00	209.76	9.024	22.00	28.29	17.359
Fall 05	SJHS	13	212.00	211.00	10.025	28.00	31.31	17.628
Spring 06	OLJHS	17	217.00	215.47	9.494	33.00	33.47	15.577
Spring 06	SJHS	13	219.00	217.15	7.755	39.00	36.46	17.826
Fall 06	OLJHS	NA	NA	NA	NA	NA	NA	NA
Fall 06	SJHS	NA	NA	NA	NA	NA	NA	NA

Table 5. Descriptive statistics on the mathematics test for cohort I: Students in the lowest quartile

Semester	School	N	Median Score	Mean Score	SD Score	Median Percentile	Mean Percentile	SD Percentile
Fall 04	OLJHS	14	205.00	202.71	6.888	16.5	15.29	7.580
Fall 04	SJHS	21	205.00	204.67	3.903	17.00	16.76	4.888
Spring 05	OLJHS	14	211.5	211.5	7.573	19.50	21.21	11.178
Spring 05	SJHS	20	211.5	211.45	9.383	19.50	21.80	14.717
Fall 05	OLJHS	12	215.50	216.25	8.508	21.00	24.25	13.356
Fall 05	SJHS	18	215.00	215.89	9.755	20.00	24.50	16.173
Spring 06	OLJHS	12	222.00	222.00	11.521	25.00	28.92	18.083
Spring 06	SJHS	15	219.00	220.80	10.157	21.00	26.47	16.300
Fall 06	OLJHS	11	225.00	221.73	10.527	31.00	28.64	14.624
Fall 06	SJHS	15	224.00	222.20	8.817	29.00	28.33	12.832

Table 6. Descriptive statistics on the reading test for cohort II: students in the lowest quartile

Semester	School	N	Median Score	Mean Score	SD Score	Median Percentile	Mean Percentile	SD Percentile
Fall 05	OLJHS	11	198.00	196.09	9.502	12.00	12.64	7.698
Fall 05	SJHS	7	202.00	196.57	10.342	17.00	13.29	7.740
Spring 06	OLJHS	7	206.00	201.71	18.163	18.00	23.00	19.485
Spring 06	SJHS	6	205.00	203.83	10.534	16.50	19.50	15.346
Fall 06	OLJHS	5	199.00	200.40	17.615	9.00	20.00	23.948
Fall 06	SJHS	4	205.00	203.50	13.699	20.00	20.50	18.138

Table 7. Descriptive statistics on the mathematics test for cohort II: Students in the lowest quartile

Semester	School	N	Median Score	Mean Score	SD Score	Median Percentile	Mean Percentile	SD Percentile
Fall 05	OLJHS	7	197.00	194.29	15.348	6.00	8.86	8.934
Fall 05	SJHS	7	208.00	207.00	5.944	17.00	16.43	7.413
Spring 06	OLJHS	5	196.00	194.80	12.872	4.00	6.20	7.463
Spring 06	SJHS	5	212.00	210.40	11.845	18.00	19.20	14.738
Fall 06	OLJHS	2	196.00	196.00	18.385	7.00	7.00	8.485
Fall 06	SJHS	3	213.00	214.00	9.539	17.00	20.67	13.868

Table 8. Descriptive statistics on the reading test for cohort III: Students in the lowest quartile

Semester	School	N	Median Score	Mean Score	SD Score	Median Percentile	Mean Percentile	SD Percentile
Fall 06	OLJHS	46	202.00	198.15	12.136	17.00	15.80	7.585
Fall 06	SJHS	32	201.50	199.16	7.167	16.00	14.97	6.949
Spring 07	OLJHS	NA	NA	NA	NA	NA	NA	NA
Spring 07	SJHS	NA	NA	NA	NA	NA	NA	NA
Fall 07	OLJHS	38	209.50	204.63	16.254	23.00	25.89	21.136
Fall 07	SJHS	31	213.00	211.16	11.521	31.00	32.84	20.823

Table 9. Descriptive statistics on the reading test for cohort III: Students in the lowest quartile

Semester	School	N	Median Score	Mean Score	SD Score	Median Percentile	Mean Percentile	SD Percentile
Fall 06	OLJHS	38	207.50	203.58	8.876	16.00	13.68	7.264
Fall 06	SJHS	28	210.00	208.89	4.003	20.00	18.57	5.022
Spring 07	OLJHS	38	214.00	210.50	12.996	21.00	20.32	13.615
Spring 07	SJHS	27	216.00	215.04	8.451	24.00	24.22	12.957
Fall 07	OLJHS	31	210.00	207.55	11.216	14.00	14.58	10.372
Fall 07	SJHS	27	212.00	213.07	9.240	16.00	20.07	13.275